Paving and Municipal Engineering

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SEWAGE DISPOSAL.

III.

As I landed in Holland the first sewage disposal works I visited in Europe were those providing for a small portion of the sewage of Amsterdam by the Liernier pneumatic system. Much the larger part of the sewage of the city is still discharged into the sluggish canals, which intersect it in every direction, cutting it up into some ninety islands. As may well be imagined, with this multitude of water channels to cross and the small height of the level streets above the ordinary water line, any ordinary sewerage system would be of exceedingly difficult application, involving either an immense number of indescribable inverted syphons across the canals, or the laying of the sewers at such a considerable depth as would make their construction exceedingly difficult and expensive on account of the water that would be encountered and the badness of the foundations. In this connection it may be stated that one public building alone required over 13,600 piles to be driven for its support. If, therefore, there is any place for which the Liernier system is especially adapted it is at Amsterdam, as it is independent of grades; in fact, that system has been found to work better with undulating grades than with a continuous slightly descending one.

The system has been applied to some 3,000 houses, which are connected by pipes with the pumping station. Besides this, the sewage of 47,000 persons is collected by what is termed the temporary Liernier system, in which no pipes have as yet been laid from the street collecting tanks, to which I have already referred. These tanks are worked and emptied by vacuum tank carts, like those

which I have already mentioned as in use elsewhere for emptying private cesspools. The paid system is used to some extent in the rest of the city, but in the greater part of it the house sewage is discharged directly into the canals, the openings of the sewers being everywhere visible. This is especially the case for houses near the canals. For those a block or so away cesspools are frequently used and only the overflow passes into the canal. As the Zuyder Zee is ordinarily about thirty-two inches above the canal level, the canals are flushed from it, generally every night, from eight to six, and on Sundays and holidays, when vessels are not moving, the ordinary connections of the canals with the deep North Sea canal (used for the shipping of the port) are closed, and the flushing water discharged into this canal at an outlet beyond the city, and from there into the North Sea at low tide. This flushing causes a current, it is said, of about a foot per second, probably much less in many of the canals, and not enough to disturb the deposits made during the day. It does, however, perform the important function of discharging the foul water for the comparatively pure water of the Zuyder Zee. At times, from adverse winds, the Zuyder Zee level is not above the normal level of the canals, and it is proposed to make alterations in existing pumps so as to be able to pump water from thence for flushing in this emergency. Two connections are made between the street tanks and the main; one for first exhausting the air from the tank, and the other, after the sewage has been sucked from the local sewers into the tank for discharging it into the main and by it to the station. Care has to be taken in house connections with local sewers to have, by uniform depth of syphon traps, an equal suction lift.

It was ordinarily the plan of Liernier to evaporate all the water of the sewage after its reception at the disposal station and to convert it into poudrette for manure. This plan has not been very successful on account of the expense and another method is now being pursued.

The sewage, which only amounts to 3,114 litres per head (only five-sixths of an American gallon) after being first mixed with milk of lime, passes by a continuous flow through a series of cylindrical iron precipitating tanks. The effluent liquor is then raised above the boiling point in a closed tank to drive off the ammonia. The

ammonia is caught and combined with sulphuric acid forming a nearly white crystalline compound, which has a considerable value in the arts, as well as for manurial purposes, and meets with a ready sale. The precipitated sludge is put through a sludge press and the cake can be disposed of for a nominal price. By this process, the superintendent, Mr. Sanches, tells me, although less of the valuable manurial elements are saved in a usable form than by the poudrette manufacture, yet so much less fuel is required that the profit realized is much greater. The plant was not entirely in working order as I saw it, but the superintendent considered with his plant completed for treating all the sewage received, that he would be able from the sale of the product to recoup as much as one-third of the expenses of operating the system. The entire expense of the system in 1890 was for the pipe connected portion 33.7 cents per head per annum, or for the sewage collected by the temporary system (which may eventually be pipe connected also) 39.8 cents per head. The expenses were unusually high, however, for that year on account of high price of coal and extraordinary repairs to steamboats. Ordinarily the connected portion of the system has only cost 25 cents per head. Nearly 75 per cent. of the houses of the pipe system are as much as 2.2 miles from the station.

BERLIN.

As I have already stated the sewage of this large city, of some 1,600,000 inhabitants, is treated by the system of broad irrigation. The city is divided into twelve separate drainage areas, each with a pumping station from which the sewage is raised directly to the farms, two districts being sometimes served by one rising main. The farms, some eight in number, to which the sewage is delivered and which belong to the city, cover an area of 18,790 acres, of those only four with an area of 11,000 acres had in 1891 been utilized. Those to the north of the city are about six miles away, and those to the south of it are twelve miles distant from the heart of the city. Storm water, as usual, flows directly into the river, draining the district, in this case the River Spree. Of the total average daily amount pumped (thirty-six million United States gallons) from 7 to 10 per cent. is storm water.

In 1890 the actual land under treatment received 4,470 United

States gallons per acre per day. This amounts to the sewage of 150 persons per acre treated, or 142 persons per acre for the total area of the farms then utilized. The sewage of Berlin is quite rich, amounting to only 23½ gallons per capita. The largest acreage of the farms is devoted to cereals, but this area can only be treated with sewage while the plants remain underground. The roots and grass crops are treated all the year round. The entire sewage is used, except for the area devoted to grass crops, where the sludge is first caught in shallow pits and sold to farmers.

The volume of the effluent is estimated to be about half that of the sewage. From 92.5 to 93.9 per cent. of the total organic matter is removed (from 97.8 to 98.9 per cent. of the total ammonia).

I visited the pumping station in district No. 3, which, though not the largest, ordinarily pumps about 5,500,000 United States gallons daily, and sometimes as much as 7,400,000 gallons. Station No. 2 ordinarily pumps about 7,500,000 gallons. I was surprised to find how entirely free the large pump-room was from any odor. It was very neat and tidy, and might have been a well ordered pumping station for water supply as far as appearances went. The yard where the sewage entered was equally free from anything objectionable. It convinced me of the practicability of locating such a pumping station in the heart of a large city without creating other nuisance than that arising from the consumption of coal. The sewage is received in a large circular well in the yard, covered with planking, from which, after passing through a coarse screen to remove anything that would interfere with the pumps, it flows to the pump-well. No deposit of moment occurs in the screening well. The only odor I noticed was when a trap-door over this well, and another over the pump well, where the storm overflow was located, were opened, and even then, as the sewage was fresh, the odor was quite slight. The engines are of the direct action type, but with a crank and fly-wheel attachment.

I also visited one of the sewage farms at Blankenberg, which has an area of nearly 2,500 acres. The ground I examined was quite sloping, and was terraced into level or gently sloping beds, separated from those next below by embankments. There is no reservoir for receiving the sewage, but it flows directly from a dozen goose necks, closed by valves, scattered over the farm, and which

are opened as needed. A stand-pipe in a central position acts as a safety vent. If the sewage is rising too rapidly in it, a flag signal notifies the workmen to draw out the sewage more freely. The carriers seemed to be entirely of earthen channels, with simple wooden distributing gates. Deep ditches serve for draining away the effluent. Where under-draining is necessary, the drains are three to four feet beneath the surface. The effluent was quite clear to the eye.

Quite a variety of crops was being grown, a considerable acreage being devoted to rose bushes. Some of the fields had ditches only at the borders, whilst others had deep ditches at intervals of five feet, the latter, I believe, for root crops. The fields are entirely flooded with sewage with varying frequency, for some crops only two or three times in a season, and for others a maximum of twenty times in the course of the year. The sewage, as received, always has a temperature of as much as 50° to 52°, the temperature of the air only occasionally falling to 14° F. Through the winter of 1890–91 (being exceptionally cold), it fell to 4° below zero. I was told that here from 3,700 to 4,200 United States gallons per acre were on the average applied daily.

I was not very enthusiastic about the freedom of the farm from unpleasant odors, the effluvium from the freshly flowed fields and from the sewage flowing from the goose neck being quite sensible. The superintendent, however, has a fine house on a central elevation. I noticed no bad odors from its vicinity. He had lived there for ten years and was a florid, healthy looking specimen of German manhood. The farm has apparently had no evil effects upon him. In point of fact, the farm is considered a good sanitary station, as convalescents are sent there from the city hospitals to recuperate their strength in the fresh, pure country air. It is almost needless to add that it is only the city's poor that are thus provided for.

The sludge pits would, I think, be exceedingly offensive, and in winter when the sewage is run into storage basins to a depth of twelve to eighteen inches, a decided nuisance must be created. I visited the farm about the 10th of May.

PARIS.

So far only about a third of the sewage from the sewers is treated by broad irrigation at Gennevilliers and Asnieres, but there is nothing special to note, except that, saving a small experimental station, all the land belongs to and is worked by private parties, who are free to use the sewage when they need it, and not to use it at all if they do not desire it. As a consequence, in wet weather, all of this portion of the sewage has, like the rest, to be turned in its crude condition into the Seine. The Berlin system of ownership and control is certainly far superior.

KINGSTON-ON-THAMES.

The sewage of Kingston, which is situated on the Thames, about twenty miles above London bridge, is treated by the A B C process under a contract with the native guano company. The works, however, were built and are owned by the town itself, and are so designed that at the expiration of the contract another method of treatment can be easily substituted, if desired, with only a little change in the machinery. The guano company receives from the corporation for their compensation an annual payment of three pence on the pound of taxable valuation (equivalent to a tax of one and one-fourth per cent.), and take all the responsibility of making the effluent satisfactory to the Thames conservancy board.

The sewage of the little town of Surbiton is, by a twenty years' agreement with Kingston, treated at the same works. As it is pumped up it is passed through a meter something like an undershot water-wheel in appearance, in order to determine its amount. The total sewage is also metered after passing through the main pump well.

The Kingston outfall sewer formerly discharged directly into the Thames. At the point where it is turned into the grounds of the sewage works an overflow is provided so that the surplus, during rain storms, takes the old course to the outlet in the river. The company is only obliged to treat forty-five gallons of sewage per inhabitant on any one day and are entitled to extra pay for any excess over this amount.

The sewage from both towns first passes through screening

chambers for intercepting coarse matter. The Surbiton sewage is pumped by a centrifugal pump into the Kingston pump well, where it receives the deodorizing mixture of charcoal and clay. The charcoal is coke—not true wood charcoal. These ingredients are ground together in a vertical pug-mill (two stones running in a circular path) and then diluted with water in a tank before being discharged into the pump well. From this pump well the sewage is lifted by a second centrifugal pump about twelve feet (extreme lift 19 feet) receiving on its way to the settling tanks its dose of alumino-ferric for precipitating the sludge. This chemical is easily dissolved in vats by allowing a stream of water to run on the cake and drops into the flowing sewage without any baffle boards being used. The settling tanks, eight in number, and holding 1,200,000 gallons, 30 gallons each for 40,000 persons, are built of concrete with brick division and baffle walls. They may be each worked separately on the absolute rest system, or two or more may be connected and run continuously. As I saw them the tanks were linked in couples and run continuously for a day; then after a settlement of 1 to 1½ hours the clear water was drawn down, nearly to the sludge, by the floating arm, already described. Sometimes the two tanks can be run several days without the sludge becoming too deep.

The effluent is run directly into the river. It was rather cloudy as I saw it, but Mr. Ramsden, the engineer of the local board, told me that it was ordinarily considerably better in appearance, and that the contractors were inclined to take advantage of the water in the Thames being muddy to turn in an effluent similar in appearance.

The sludge is pumped up into a large open circular vat out of doors; there seemed to be very little odor from it. From the vat it is drawn into the montejus by a partial vacuum and then forced by compressed air (100 pounds to the square inch) into sludge presses; the drippings from which are returned to the sewage to be treated again.

The sludge cake is broken up and passed throught a revolving Borwick's drying cylinder with fire directly underneath, it being carried from one end to another by spiral guides. It remains in the drier about five minutes. It is carried as it falls from the drier by an elevator to the floor above where it is bagged or barreled,

sometimes being first ground. It is said to meet with a sale at £3 10 s. per ton. In a dull season it may be stored for some time on the premises, giving no offense from odor. In the rooms where the sludge cake was being dried in the hearter and barrelled, the odor was not very pleasant. All other parts of the works, however, were quite free from anything disagreeable. In fact the grounds are but a few minutes' walk from the heart of the town, and the opposite side of the Thames, here a narrow stream, is lined with fine villa residences, with beautiful velvety lawns sloping down to the water edge.

The sewage of 38,000 to 40,000 persons was being treated, ordinarily amounting to one and one-fourth million gallons daily, and occasionally rising to two millions. They were also expecting to treat soon the sewage of 2,500 persons in Hampton Wick, to be pumped up and delivered by a Shore's ejector.

There are eight engines for pumping and for running the works, three of which are compound, and five triple expansion. The works cost £23,000 and have a capacity for 50,000 persons, and the machinery is capable of doing much more work if more tankage is provided, for which there is plenty of room.

CHISWICK.

This town of about 22,000 inhabitants is also on the Thames a short distance below Kingston. It was originally sewered on the separate system, with only rain water from the roofs admitted. Rain water from back yards was subsequently received and finally the water from a few streets also taken in.

There is a storm water overflow, so that excessive rain-falls can pass off into the river, but it is said to be very rarely needed. (Sewage received thirty-three and three-fourth gallons per head of which twenty-one and three-fourths is sewage proper.)

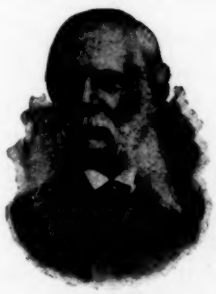
The sewage as it flows from the lifting pumps is first treated with milk of lime. The lime is prepared in small vessels kept full of water forced in at the bottom while the quick lime is thrown in at the top. The mixture is kept stirred up by revolving arms attached to a horizontal shaft. The milk of lime is discharged over a lip into a chamber, from whence it is delivered over a second lip to the sewage. It enters the sewage in a mixing chamber, where the agitators thoroughly incorporate both together and at the same time create the sewage. The agitators consist of two shafts with

eight flat paddles on each, revolving in opposite directions, and closely spaced so that the paddles work into each other. The sewage then flows into a rounding channel to other similar agitators where a solution of Spence's alumino-ferris is introduced. The alumino-ferris comes in large cakes costing, in 1891, $12.25 per ton. It is so readily soluble that the cakes are torn promiscuously into a hopper on which jets of water play and take up a sufficient quantity of it in solution before flowing out through the grating in the bottom. The amount of the chemical used is varied simply by varying the amount of water turned on. From six to eight grains per gallon are used, and about seven grains of alumino-ferris.

There are four large and four small settling tanks with a total capacity of 800,000 imperial gallons. They can be worked continuously, but are generally worked on the absolute rest system the precipitation only taking about an hour, after which the clear water is drawn off by the usual radial floating valve. A bulk of timber floating up and down in grooves and reaching across the tank, prevents any grease or floating scum from passing off through the valve. The effluent flows directly into the river. Unfortunately there was not any running when I visited the works, so I could not judge of its character. The tanks were originally provided with coke filters for the effluent, but their use was found unnecessary.

The sludge flows into a sludge pit and the tanks are cleansed with squeegees in the usual way before another charge is let in.

About fifty tons per week of the sludge cake are turned out from the filter presses. The market gardeners in the vicinity are willing to take it away gratis at certain seasons of the year, especially in the winter, but when the crops are fairly started it is a drug in the market and a shilling a load has to be paid for hauling it off.



J. Foster Flagg. Biographical Sketch in June Number, 1893, page 319.

In the summer gas sometimes forms in the tanks, throwing masses of the sludge to the surface which has to be forced with paddles.

An elaborate revolving screen, turned by power and washed by water jets was installed for screening coarse matter before the sewage reaches the pumps, but it gave so much trouble in working, and a simple fixed grating answering all the needs of the case, its use was abandoned.

J. Foster Flagg.

COMPARATIVE VALUES OF VARIOUS PAVEMENTS.*

A PAVEMENT is an engineering structure, and, being an engineering structure, it demands just as much study and just as much thought in its design as a larger engineering work. A bridge engineer would hardly think of recommending a cantilever bridge without examining the locality, because another style of bridge might be cheaper, and better adapted to the place. In any other engineering work you would hardly decide what the work should be without examining into what the locality requires; but we find with pavements the usual method is to write to some other large cities and find what they have done, and, without regard to local resources, adopt those specifications, sometimes containing clauses which are simply absurd for the particular locality in which they are to be used; and these specifications are often adopted without any regard to the particular needs of the town where the pavement is to be laid. I know of a city, not 100 miles from Chicago, that had macadamized streets on which there was at least 12 inches of good, sound macadam; when the streets were paved, the macadam was carted from the street and hemlock plank imported into the town at considerable expense and cedar block laid on the hemlock foundation. In that place, even if it had been necessary to obtain new broken stone, the work with the stone foundation could have been done much cheaper, and have given much better results both as to maintenance and ultimate life of the pavement.

Another example—not in the line of cedar blocks, but of brick pavements. Brick pavement was first introduced into this state at Bloomington, where there is no local stone and stone must be imported at great expense; brick is the cheapest thing they could have for the foundation, therefore they spread a little sand or cinders on their subgrade and placed a layer of brick flatwise and put another course of sand and another of brick from the Bloomington brick yard. This plan has been widely adopted without a thought of what could be done in different localities; it was adopted in places where there was any amount of stone and needless expense has been involved in the construction of pavement. Sometimes

*Discussion before the Western Society of Engineers.

paving bricks are imported at large expense, costing $12 or $14 a thousand, and used over 8 or 10 inches of broken stone as a foundation. I have known of brick being put in as the foundation, that is, the second course of brick laid flatwise, where that work costs 40 cents a square yard, and where it was entirely needless. It was simply so much money thrown away. At three places in this neighborhood, Clinton, Iowa, Davenport, Iowa, and Rockford, single course pavement has been tried. In Davenport 8 inches of broken stone has been used, at Rockford and Clinton 6 inches; along the Ohio river 6 inches of gravel is used, in Peoria a large sized brick is used on 6 inches of gravel; all of these making good, substantial foundations for medium traffic; but the point that I wish to make as strong as possible is that the local resources of every locality should be canvassed before the style of a pavement is decided on, and before the construction of the pavement is decided on, both as to the quality and character of the material from which the surface is to be made and as to the character of the foundation, for I believe that this is the only way to get the greatest economy, and I speak of economy not entirely in a financial way, but in the taking into consideration all the demands which are intended to be fulfilled by a pavement.

At the October meeting of the society in the discussion of Mr. Appleton's valuable paper on cedar block paving it was suggested that an estimate of the comparative values of various pavements for localities in and about Chicago would be of interest. In furtherance of this suggestion the following notes on the various kinds of pavement are offered.

There are several qualities which must be considered when discussing the kind of pavement for a street. The importance of these qualities vary largely in different localities with the class of traffic, use of property fronting on the street, etc.

The rank of relative importance to be given to the different qualities must be determined for each particular case. Those qualities may be considered under the heads of:

1. First cost.
2. Cost of maintenance.
3. Facility of repairs.
4. Durability under traffic.

5. Freedom from noise.
6. Freedom from dust.
7. Freedom from decay.
8. Freedom from absorption.
9. Foothold for horses.
10. Ease of traction.

Some of these qualities overlap, but they are all more or less independent of each other.

1. First cost, and 2, cost of maintenance.

In Table No. 1, the writer has given an approximate estimate for Chicago and its suburbs of the first cost of various pavements; the cost of their renewal when worn out; their approximate wear under light, medium and heavy traffic, and also the approximate cost per year for a term of fifty years under these conditions.

TABLE I.

APPROXIMATE ESTIMATE OF COST OF VARIOUS PAVEMENTS, AND RELATIVE COST FOR TERM OF YEARS IN CHICAGO AND SUBURBS.

CLASS OF PAVEMENT AND KIND OF FOUNDATION.	Cost per sq. yd.	Cost of renewal.	Years of wear under different classes of traffic.			Cost per year for term of fifty years under different classes of traffic.		
			Light.	Medium.	Heavy.	Light.	Medium.	Heavy.
Cedar on 2-inch plank.....	$1.00	$0.90	10	7	..	$0.24	$0.35	$....
Cedar on 6″ rubble.....	1.25	0.80	12	8	..	0.22	0.30	....
Cedar on 9″ rubble.....	1.40	0.80	..	9	4	....	0.30½	0.56
Cedar on 6″ concrete.....	1.40	0.80	12	9	..	0.22½	0.30½	....
Cedar on 9″ concrete.....	1.65	0.80	..	10	5	....	0.29	0.49
1 course brick on 6″ rubble...	1.45	1.15	30	15	..	0.17	0.27	....
1 course brick on 9″ rubble...	1.60	1.15	35	20	12	0.16	0.22½	0.30½
2 courses brick on 6″ rubble...	1.95	1.15	35	20	12	0.17	0.23	0.31
1 course brick on 6″ concrete.	1.60	1.15	35	20	10	0.16	0.22½	0.36
1 course brick on 9″ concrete.	1.85	1.15	..	25	15	....	0.20½	0.29
Sheet asphalt on 6″ concrete..	3.00	2.00	15	8	..	0.50	0.75	....
Granite on concrete.....	3.50	2.00	50	30	15	0.28	0.37	0.54
Granite on 6″ rubble.....	3.15	2.00	50	25	12	0.27	0.35	0.56
Cobblestone on 6″ gravel.....	0.90	0.70	..	15	8	....	0.16½	0.25
Macadam granite dressing...	1.35	0.75	10	6	..	0.26	0.37½	....

In the last item, the first cost of the pavement, the cost of renewals and the interest of 6 per cent. on these amounts for the term of years invested is taken into consideration.

This table is partially based on certain experiments made in St.

Louis, Mo., and others by Prof. I. O. Baker, of the Illinois State University, as given in his pamphlet on Paving Brick, and is substantiated by the writer's own experience and observation. The writer is more familiar with brick and cedar block paving and less so with granite, cobblestone and asphalt. He believes, however, that all estimates are conservative and within a safe margin of the actual cost and length of service, provided the work is properly done with first-class material and properly repaired when taken up for laying or repairing pipes, etc.

When a pavement is considered entirely unfit, or unnecessarily expensive for any class of traffic, no estimate is given.

3. Facility of repairs—is a matter of considerable importance to all cities; for the pavements are continually being torn up for laying and repairing the various pipe conduits, etc., which are laid beneath their surface. Any pavement is injured by repeated and careless disturbance, and frequently this is the principal cause that hastens their destruction.

Cedar pavements on plank foundations are seriously injured when trenches are cut through them; for their homogeneous bed on which depends their even surface and the equalization of pressure on their foundations is practically destroyed. The plank being cut off in sections as long as the width of the trench, when replaced, has long, unbroken joints which are lines of weakness. Along these lines the pavement will settle and become uneven, which produces rapid wear. It is true some cities require a whole section of pavement to be taken up when it is necessary to disturb it at all, thus avoiding the cutting of the plank foundation. This is very rare, however, for in most cases the foundation plank are cut as above described. Brick, granite or cedar pavements on fragmentary foundations (that is, foundations of broken stone, sand or gravel) are much more easily repaired. In these cases homogeneity exists in the foundation by contact under compression and not by a continuity in the foundation material itself. Consequently a disturbance is not a permanent destruction to its homogeneity as in the case of the plank foundation. For in these cases by proper ramming the foundation can be made, almost or quite as if undisturbed and no marked lines of weakness result.

With concrete foundations lines of weakness are avoided when

repairs are made by the union of new and old material in one homogeneous mass by the cement.

Brick being uniform in size are more easily replaced than granite and at a consequent less expense.

Asphalt pavements necessitate a somewhat expensive plant and expert help for its proper repairs, which places this pavement at a disadvantage.

4. Durability under traffic—results from the resistance of the material to:

A. Crushing by the wheel load.

B. Abrasion by shoes of horses and friction of wheels.

C. Impact due to passage of loads over a rough surface.

A. Crushing—Granite will crush under load of from 13,000 to 22,000 lbs. per sq. inch.

Paving brick	10,000 to 18,000 lbs. per sq. inch.
Cedar	5,000 to 6,000 lbs. per sq. inch.
Asphalt concrete.	

From this it will be seen that although the compressive strength of granite is on an average greater than that of paving brick yet the brick is sufficiently strong to afford a large factor of safety over the maximum load to which it will be subjected as a pavement.

Cedar and asphalt on the other hand have a much less compressive strength and will be rapidly injured and destroyed under the heaviest traffic.

B. Abrasive (by rattler test 1½ hours duration).

Granite lost from ½ to 3½ per cent. (I. O. Baker).

Paving brick from 2½ to 5 per cent. (I. O. Baker).

Cedar probably less than either (no tests).

Asphaltum concrete almost destroyed (St. Louis test).

From this it will be seen that granite again outranks brick, and it is probable that cedar if tested in the same manner would show a smaller loss than either.

Asphaltum concrete although almost destroyed in the St. Louis test is yet sufficiently tough to withstand (when homogeneous and continuous) the impact and abrasion of the horses' shoes.

The rattler test for abrasion furnishes, however, hardly a fair comparison for materials having such different physical qualities as granite or brick and cedar or asphaltum.

C. Impact is most important in rough pavement.

A loaded wheel rising on an irregularity in the surface falls as it passes over it, producing an effect in proportion to the weight on the wheel and the height of the fall.

This is the principal cause of wear in granite and cobble-stone pavements, and although granite exceeds brick in crushing and abrasive strength, its roughness makes it average little if any better than brick in durability.

The smoothness of asphalt gives it considerable durability under traffic in spite of its inferior crushing and abrasive strength. But when once broken, unless promptly repaired, it will rapidly go to pieces under the impact caused by the surface irregularity.

Any depression or irregularity in a paved surface of any kind will produce a local failure through this cause, if not promptly remedied.

5. Freedom from noise.

Freedom from noise is of more importance than is commonly conceded. There is no doubt but that the continued noise of traffic gives rise to certain nervous diseases, and it is certainly often a great disadvantage. So much so that it is frequently necessary in cases of sickness to spread bark, sawdust or straw over the pavements. And I believe the courts of this city are sometimes obliged to have tan bark spread over the neighboring pavements in order to hear testimony and transact business.

The noise of a pavement increases with its roughness, and to a limited extent with its hardness, although this last item is comparatively insignificant.

Cedar, when smoothly laid, is the least noisy pavement except macadam; asphalt, smooth but harder, causes a noise from the horses' shoes, but otherwise is a quiet pavement.

The same may be said of brick, which is only slightly more noisy than cedar and asphalt.

As for granite, the rattle and roar of Chicago's streets is familiar to all; there is only one pavement more noisy, and that is cobble-stone.

6. Freedom from dust.

The dust of a pavement is due, first, to the disintegration of the paving material itself, and, second, to the retention of street litter

by irregularities in the pavement, which prevents its proper sweeping and cleaning.

Asphalt, with its smooth, continuous surface, ranks first in this regard. Brick, almost as smooth and with close and well-filled joints, ranks next.

Granite produces little dust from its own disintegration, but its rough surface gives lodgement to dust from other sources.

The same is true of cobble stone to even a greater extent. Cedar, in its wear, gives off a light and very penetrating dust.

7. Freedom from decay.

Brick is made of the most lasting material, its elements have reached their most stable form.

Granite, although it may be disintegrated in time, is eternal as far as atmospheric changes are concerned when compared with the life of the pavement as limited by other qualifications.

Asphalt will rot out unless kept clean; this usually occurs in the gutters, and is not accompanied, as far as the writer knows, by unsanitary conditions.

Cedar, like all wood, is liable to decay; this element is an important one in the life of a cedar pavement, and under light traffic is the most effective in its destruction. Its decay, giving rise to noxious gases, produce unsanitary conditions, which are at least undesirable and under some conditions may be dangerous.

It may be here mentioned that after the epidemic of yellow fever in Memphis, Tenn., in 1876, one of the recommendations of the National Board of Health for the sanitary improvement of the city was that all wood paving should be taken up and carted out of the city. And on this recommendation several miles of wood pavement were so removed.

8. Freedom from absorption.

The surface of a pavement should be impervious to liquid filth, so that the subsoil may be pure and the pavement itself in good sanitary condition. In this regard asphalt ranks first, as it is practically impervious and it is a continuous sheet. Paving brick absorbs only from 0 to 4 per cent. of their weight and become, within a few weeks after they are laid, as impervious to the seepage of water through their joints as asphalt. Granite is in itself impervious to water, or practically so, but its irregularities of surface

are apt to retain liquid impurities long enough to allow of some absorption through its joints. Cedar will readily absorb liquid filth and exhale it again in dry weather, and its shrinkage from dryness or cold often opens seams which allow liquids to reach its foundation.

9. Foothold for horses.

The rougher pavements have here the advantage. Small cobble stone undoubtedly furnish the best foothold for horses, and small granite blocks may be ranked next. The many joints in a brick pavement offer facilities in this regard without the roughness of cobble stone and granite.

10. Ease of traction. Table No. II, derived mostly from the experiments of different authorities whose names are given therein, gives a comparative statement of this point.

TABLE II.

RESISTANCE TO TRACTION OF DIFFERENT CLASSES OF ROAD SURFACES.

(Horse moving at a pace.)

Character of Surface.	Resistance in Terms of Load.	Authority.
Sand	1—5	Bevan.
Common gravel	1—15	MacNeil.
Hard rolled gravel	1—30	Minard.
Cobble stone	1—16	Morin.
Good macadam	1—30 to 1—54	Morin.
Granite block	1—20 to 1—60	MacNeil.
Plank roadway	1—40 to 1—67	Morin.
New cedar block	1—50 to 1—80	
Old cedar block	1—20 to 1—50	
Good block	1—80 to 1—120	
Good asphalt	1—133	Gordon.
Iron tramway	1—200	Gordon.

In Table No. III the writer has tabulated these qualities and classified the different paving materials according to his idea of their relative rank.

TABLE III.

CLASSIFICATION OF DIFFERENT MATERIALS AS REGARDS VARIOUS QUALITIES.—FOR CHICAGO AND ITS SUBURBS.

(All Pavements in First-class Condition.)

Qualities.	RANK.					
	1	2	3	4	5	6
First cost	Cobble-stone.	Cedar.	Macadam.	Brick.	Asphalt.	Granite.
Cost of maintenance	Brick.	Granite.	Cobble-stone.	Asphalt.	Cedar.	Macadam.
Facility of repair	Macadam.	Brick.	Granite.	Cobble-stone.	Cedar.	Asphalt.
Durability under traffic.	Brick.	Granite.	Cobble-stone.	Asphalt.	Cedar.	Macadam.
Freedom from noise	Macadam.	Cedar.	Asphalt.	Brick.	Granite.	Cobble-stone.
Freedom from dust	Asphalt.	Brick.	Granite.	Cedar.	Cobble-stone.	Macadam.
Freedom from decay	Brick.	Granite.	Cobble-stone.	Macadam.	Asphalt.	Cedar.
Freedom from absorp'n	Asphalt	Brick.	Granite.	Cobble-stone.	Macadam.	Cedar.
Foothold for horses	Cobble-stone.	Granite.	Macadam.	Brick.	Cedar.	Asphalt.
Ease of traction	Asphalt.	Brick.	Cedar.	Macadam.	Granite.	Cobble-stone.

Of foundations, plank or boards is, in Chicago, the cheapest and poorest foundations, especially so in clay soil where the water can not rapidly drain away.

For light traffic, the fragmentary materials (rubble, gravel, sand, etc.), or sand with a layer of brick laid on their side, or six inches of concrete, make good foundations, the selections depending on the local resources.

For medium traffic, nine inches of stone or gravel or six inches of gravel or stone, with a layer of brick laid on their side, bedded in sand, or six inches of concrete, will give good results.

For heavy traffic the stone or gravel should be at least a foot in thickness or the concrete at least nine inches.

All sub-foundations which are retentive of water should be properly and thoroughly drained.

In regard to the use of wooden pavements in Europe, Messrs. Q. A. Gillman, F. V. Green and E. P. North, all noted experts on paving, in their report to the mayor of Philadelphia in 1884, write: "We are aware that at the present time large amounts of wooden pavements are being laid in London and Paris. As laid in those cities, upon a foundation of concrete of Portland cement and of

blocks of seasoned wood especially treated with preserving compound, they undoubtedly make a more durable road covering than the wooden pavements which proved so signal a failure in this country several years ago. But according to information received very recently from the French engineers, it is expected to renew the wood every four or six years, depending on the amount of travel. The first cost of the pavements now being laid in Paris is equivalent to about $4 per yard, and the contract price for repairs and maintenance is 49 cents per yard per annum, the contract being made for 18 years. This brings the total cost during 18 years to $12.82 cents, which is about three times the cost, during the same period, of the pavement which we recommend."

Those gentlemen recommended granite, sheet asphalt and asphalt blocks for different grades of streets. As brick was at that time almost unknown it was not mentioned in the report. But it is worthy of note that Philadelphia is now laying considerable brick paving. *Daniel W. Mead.*

THE FATE OF A REMONSTRANCE.

A RESIDENT engineer who had been a fellow-student at the Massachusetts "Tech," had given Beverly a card to the Mercantile. Sitting before a wide window in the club's rooms at the top of its own tall white building Beverly looked out over the roofs and spires of Eureka, and concluded that the town was not so bad after all. Beverly had grown the least bit blasé as to boom towns. He had spent five years in dealing with them, and he knew the weaknesses peculiar to all. Without consulting bank statements and clearing house reports, he could judge, by the general air of a place, the state of its boom; he knew the limitations of territory, the danger of competing cities and the deficiencies of transportation. He had come to this knowledge in his capacity as manager of the Popocatepetl Street Paving Company, Ld., of Boston, Mass. The Popocatepetl was a prosperous concern, and it was Beverly's good luck to own a considerable interest in it. To its success the Bostonian had contributed much; he knew the business thoroughly. His accuracy in estimating the cost of a yard of highway was not second

to his unerring judgments as to the character of men and their possible service to him. He was, moreover, a good fellow; he had likable qualities which made it a pleasure for people to do business with him. Members of boards of public works which were obliged to reject his bids generally found opportunity privately, individually and unofficially, to express deep regret.

"It's a great pity that towns can't be built on a system," said Willoughby, the engineer friend, to Beverly, when they met after dinner in the club rooms.

"I've often thought of that," the agent of the Popocatepetl replied. "It would be possible then to prevent many ills and to approach high ideals of good government. But the process of evolution carries experience with it, and experience is a prime essential in city building. It is better than a system."

"But, looking at the matter socially, if some extraordinary commissioners were entrusted with the duty of selecting the people who should reside in a city, would that lead up to the ideal?"

"Well, it might, but that would be a dangerous form of state socialism," returned Willoughby.

"True, and it could never be made operative; but the social line ought to be drawn somewhere, I sometimes think. May be the sense of humor would be a good basis for examination. The bores seem to prosper in society. But perhaps here in Eureka you don't have any society," Beverly concluded with a smile.

"Altogether wrong, my Bostonian," said Willoughby. "Come up to my house to dinner to-morrow evening after the fret and worry of possible and acquired contracts, and let me show you a few people who are not products of the 'boom,' and who are almost as good as anything you find between Jamaica Plain and Charlestown."

"Good enough," said Beverly. "I know you would not offer me bread, socially speaking, and defraud me with a stone—or, to talk shop, a vitrified brick."

The Popocatepetl was already engaged in putting down pavements on several of Eureka's streets. Beverly was on the ground, incidentally to supervise this work, though it was really in charge of a superintendent, but there was a more important contract soon to be awarded, and his chief errand was to secure this for his com-

pany. Eureka had been booming for so long that even the speculators who were inclined to watch warily for changes in the tide had begun to accept as permanent, phenomena of prosperity and growth which, it had seemed, could only be transitory and unstable. But even jealous Jeremiahs in neighboring cities had ceased to twit Eureka about the outlook for gas since a promising coal field had been discovered at the back door of the town. Now that it was no longer incumbent upon Eurekans to carry on their booming day and night they were turning their attention to the serious business of beautifying their town and awakening within it those forces, æsthetic and intellectual, which produce the real flower of a community's life. A new library building, patterned after a Florentine palace, was being reared, and some attention was being given to the construction of school-houses that should be handsome, and not unsightly barracks.

But the crowning achievement was to be a boulevard, of which the basis already existed as Sycamore avenue, a residence street which crossed the city transversely and led off into the country toward a river which was to be made use of in the building of a park. It was the proposed improvement of Sycamore avenue which had brought Beverly to Eureka. Five miles of street were to be paved in some style not yet decided upon, for there was a well organized, vigorous and energetic opposition to the whole scheme.

The Eureka *Evening Transcript*, representing the old, before-gas element of the town, was the organ of the anti-improvement faction. It was spokesman for a lively lot of property-owners who opposed the projected boulevard, either because of the cost, or because they did not want to have a fashionable drive created on their conservative and dignified avenue.

The Reverend Pinckney Priceless, whose church, situated on Sycamore avenue, was the official place of worship of the conservatives, had preached a sermon against the improvement. This discourse was full of the spirit of Ruskin, and it was plentifully sprinkled with quotations from the poets. Asphalt was, in his opinion, a production of the infernal regions, and vulcanite and vitrified brick were exports of the same tropic place of punishment. This sermon, after its delivery at the Sycamore Tabernacle, was printed in pamphlet form and distributed freely among all the prop-

erty-owners on Sycamore avenue. A copy of it was filed with the board of public works, and by the clerk of that body endorsed as follows:

"In re Sycamore Boulevard.
"Exhibit 97.
"Filed June 3, 1892."

The Hon. Michael Malloney, a member of the board, had sniffed the air contemptuously when this eloquent protest was filed, and he remarked somewhat profanely upon the unwarranted interference of "jay preachers" in public affairs.

Beverly had arrived at Eureka at a critical time for the Sycamore improvement. The matter was to be finally determined by the board at a meeting to be held three weeks later. Of course the Popocatepetl was interested in promoting the cause of the boulevard; but half a dozen other companies were awaiting the board's action, ready to bid if the improvement should be authorized. Both progressives and conservatives were industriously engaged in getting petitions and protests ready for presentation to the board. Ordinarily, remonstrators had to make a showing that they constituted two-thirds of the property-owners on a street, but the fight was likely to be close, so an order was issued that the decision would be made on the actual representation of front-foot ownership. This was the solution of the matter offered by the Hon. M. Malloney, and what the Hon. Mike said "went," generally, with the rest of the board.

The Popocatepetl's agent had got himself into a suit of dress clothes ready for dinner at his friend Willoughby's, when he was sought at his hotel by Major Malvern Musgrave, one of the most violently aggressive of the progressives. This Eurekan had only lately established himself in a formidable palace on Sycamore avenue. He was the leader in the movement for the building of the boulevard. He liked a horse, and wanted some place to exploit his stable.

"She's going to be a tight squeeze," said the Major to Beverly. "You can't tell who's going to beat. There will not be a big margin on either side."

"Well, if there's anything I can do to help along the good cause let me know," replied the young man. "Maybe you can return the

favor and help me get the contract if the board decides for us—please note the 'us.'"

"My dear boy," said the Major impressively, "it's as good as yours if the board decides our way. But what would you advise putting down, brick? I'm kind o' prejudiced in favor of brick."

Beverly had risen to put on his top coat. He took from the mantel a lump of curious looking substance.

"D'ye see this, Major?"

The Major examined the object critically.

"Don't give it away," Beverly enjoined, "but here's a new paving material. It's altogether new and has never been used except in experiments at our place on Nantucket. I discovered it myself in Mexico last winter,—it's lava dug out of Popocatepetl. There's millions in it!"

The Major sighed wearily. "The liars are not all dead yet," he said. He and Beverly went forth together, the former to write communications to non-resident Sycamore property owners who had proved unresponsive, and Beverly to dine at the Willoughbys.

Willoughby did not live on Sycamore avenue, but on a cross street, adjacent to the fashionable thoroughfare. He was a bridge-builder of success and fame. Eureka respected him as the man who had built the high bridge at Beaver Dam and the horse-shoe-shape viaduct at West Eureka.

"Rejoiced to see you, my asphalt-hearted friend," was his cordial greeting to Beverly. "You will find Mrs. Willoughby semi-civilized at least," he said as the Bostonian was presented to his hostess. "She is Eurekan born, and I do not believe she has ever climbed to the top of the Bunker Hill Monument."

"It's your husband's joke that I'm a bean-fed darling from Boston Back Bay," explained Beverly, "Whereas he really thinks me a mossback. He brings me here to shame me by a view of the exotics of Eureka."

The Popocatepetl's representative found himself one of six guests. Willoughby had brought in "some of the neighbors," as he expressed it. First of all were the Reverend Priceless and his wife, who lived around the corner on the famous avenue. To these, in a comfortable, provincial fashion, he added the family doctor, Woodruff, and his wife. Beverly's feminine complement was Miss

Eleanor Whiting, and after he had taken in Mrs. Willoughby this young woman sat at his right hand.

Miss Whiting had been to college, and she enjoyed the reputation of knowing "things," and of being at times sarcastic. She was an orphan, and lived in a quaint old house on Sycamore avenue. It was a venerable mansion, which antedated by many years the demoralizing influences of gas and town-lot deliriums. Miss Whiting had drunk in no little New England conservatism in her four years at Northampton—she was fond of old things.

"We are all on our mettle to-night," said Mrs. Willoughby in the awkward pause which seems inevitably to accompany the serving of soup, "because Mr. Beverly comes from what Major Musgrave calls the effete East, and is sceptical about the civilization of the gas lands."

In a few minutes she was busily engaged in comparing notes on recipes for sherbets with Dr. Woodruff.

"I hope our gas does not float in the air like the odor of Silas Lapham's mineral paint," remarked Miss Whiting, with inward congratulation that the weather had been disposed of in the parlor before dinner was announced.

"No, the town is well deodorized," Beverly replied, "but the flambeaux by night are a little formidable. Don't you think so? I hope you have none before your portal."

"Of course not," answered Miss Whiting, "but only because it is a flagrant waste of gas to burn it that way. I think they are lovely."

"But so disagreeably boastful," persisted Beverly, "a sign to all the world that you are 'getting there,' as your phrase goes."

"Whose phrase, pray?" inquired Miss Whiting, resentfully.

"Oh, I beg your pardon; I was merely charging it against the whole Western country. It's an occidental idiom, isn't it?"

"Possibly, but it may have come from Boston. I have heard it as far east as Springfield, I'm sure."

"Ah, so you know Springfield?"

"A little, from having lived near there for four years. An effort was made at Smith College, of which a good Bostonian must have heard, to tone down—is that Western?—my barbarism."

"And I, too, have been to that shrine of St. Sophia," Beverly rejoined. "I think I have had cousins there," he said, smiling.

Miss Whiting smiled, too.

"Male cousins abound in and about women's colleges."

It now developed that Beverly knew a girl at Pittsfield whom Miss Whiting had visited once upon a time, and the line of communication was further strengthened by the fact that in her Junior year she had gone through the "Tech" with some other girls from Northampton who were interested in science.

Willoughby was explaining to Mrs. Priceless the advantages of a certain suspension bridge which he was building, and Mrs. Willoughby passed from sherbets to a discussion of the work of the Eureka Women's Street-cleaning Auxiliary, of which she was third vice-president, and to which Dr. Woodruff had lent the smile of his approval. Now and then the conversation would become general for a few minutes, as it may with eight at table, but the tete-a-tete prevailed.

"Being a 'Tech' man you must be a chemist, an engineer, or something of the kind," ventured Miss Whiting, selecting with an assumption of seriousness the fork for her salad.

"It's the proper thing, I believe, to forget what one's degree is, but I think mine followed, if it was not a reward for, certain endeavors to learn civil engineering."

"Then you are probably a railroad builder—a pioneer who leads the way for progress."

"That is very pretty, but I am nothing so splendid; I make streets."

"Oh!" a little coldly, "you carry around a dreadful machine, labeled 'Vesuvius,' or 'Mt. Ætna,' tear up the streets, and maintain chaos for a life-time, and make a solid rock out of the highways, so that one never has peace afterward. And you from Boston! Never in the world! I'm sure your home is Philistia."

Beverly laughed. "You are hard on me. There's no mistaking where your home is; you're an eloquent delegate from Sycamore avenue."

"A delegate and a remonstrator. I'm a tax-payer whose rights are about to be usurped by cruel neighbors."

It was an indecent thing to do, but Beverly was a Yankee, and

he wondered how many front feet this fair remonstrator represented.

"I should not have taken you for a helpless tax-payer," he said, "but the menace of street paving must furnish a tragic element in your life?"

"Yes; it has made a modern Muse of Tragedy of me. My mask is up!"

It was, however, taken down quickly, and when coffee was served in the parlor, Beverly and the charming obstructionist from Sycamore avenue had forgotten municipal improvements in less serious generalizations.

Miss Whiting's aunt, companion, chaperon, guide and philosopher, was another Miss Whiting, whose only particular and tangible interest in life was orchids. Beverly had a friend at Jamaica Plain who had taught him some things about orchids, so that the call which he presently made at the Whiting house passed off pleasantly enough. The orchid-loving Miss Whiting so far evidenced her approval of the street-paver as to ask him to drive with her and her niece on a stated afternoon. It chanced that in making this engagement she had overlooked a meeting of the directors of the Eureka Association for the Relief of the Indigent, set for the same hour; but it was decided that the philanthropic lady should be dropped at the directors' meeting and called for later. The Whitings had a four-wheeled cart, which, Beverly said to himself, "was not so bad." He noted, also, with no little interest, the wide front of the Whiting place, which was on the edge of the town that had been, but was now far within the ambitious boundaries of the new Eureka.

"A good five hundred feet," he commented to himself, as he clambered to the back seat and assumed the attitude which is conventionally adopted by young gentlemen who are driven in carts by young ladies. He was quickly sensible that Sycamore avenue was a pretty bad thoroughfare. It was as full of "chuck" holes as a decrepit corduroy road. The cart lurched like a cat-boat in a choppy sea as the fair whip steered around mud puddles and ruts with the skill of long practice on poor highways. It was a pleasant relief when a turn was made into the brick paving of a side street, where

Miss Whiting, senior, went to sit in the Indigent Association directory. Beverly succeeded to her place, and the drive was resumed.

"Very good pavement this," said the engineer, indicating the brick under the wheels.

Miss Whiting gave particular attention to the removal of a fly from the back of the horse with her whip.

"Very disagreeably noisy you mean. I have never been able to determine which is the noisier, asphalt or brick. There may be other kinds, but all are bad."

Beverly was amused. "The respective merits of street-paving ingredients have been discussed a good deal without any result being reached," said he, with the smile of professional wisdom.

Miss Whiting had true local pride, which now asserted itself in a return to Sycamore avenue. Sycamore was the Euclid avenue, the Michigan boulevard, the Druid Hill Park, of Eureka. Beverly groaned in spirit at the thought of a protracted drive on this delectable thoroughfare.

"Don't you think your street here would be helped if something were done to patch it up?" he asked tentatively. The driver's attention had been diverted by the quick pace of a horse behind her, and with the apprehension of a good whip she turned to see if her own property were in danger. In this luckless moment the cart plunged deep into an abyss of mud, shaking up the driver and the driven and splashing mud in prodigal volumes over both. Beverly continued his comment gravely, drawing his handkerchief to wipe a dash of mud from his face. If a very pretty young woman may be said to look wicked Miss Whiting certainly wore such a look at this time. She was aware that Beverly was laughing at her, and he took a malicious pleasure in continuing his exasperating comment.

"This is a lovely street—overhead; but wouldn't a little, just a little attention from the despised street-makers help it? These are handsome houses, the lawns are grateful to the eye, and the trees are delightful; but in the midst of all these joys we are in—in the neighborhood of death."

It was a warm afternoon in late August, and Sycamore avenue was a good road to be traveling in spite of its weaknesses. Miss Whiting, too, was a bright feature of the landscape. She was "well

made up,'' Beverly noted, and the spatter of mud on her gown could not conceal its merits nor hide the unmistakable handiwork of a capable dressmaker. She was "not as all other women are,'' for not many young women can have blue eyes so honest or a smile so winning. Even if her name, as the payer of tax on five hundred front feet of Sycamore avenue property, was signed to a remonstrance against a sadly-needed improvement, which the manager of the Popocatepetl was interested in having made, the same manager in his unofficial capacity was deeply sensible of a gracefully curved cheek, of soft brown hair that glistened in the sunlight, and of two small brown-gloved hands which managed whip and reins in the most pleasing fashion imaginable.

In the course of an hour the Popocatepetl's representative interspersed lively comment on the foibles of the day with a very substantial lecture on street paving, which it was possible to illustrate by the roads which they covered. He even explained about the Popocatepetl lava, which, he insisted, was noiseless, and would not cause distress to the peace-loving property-owners along roads fortunately paved with it. When the benefactor of the poor had been picked up and the trio returned home, Beverly felt that he had put in the time much more pleasantly than if he had been button-holing members of the board of public works, or consulting the prosperous Musgrave.

The cart dived precipitately into a small valley in Sycamore avenue, near the Whitings' gate, and the accompanying wrench to the harness caused one of the traces to tear out of the single-tree. Beverly calmly repaired the damage by cutting a new hole with his penknife, commenting meanwhile on the perverseness of leather and the economic value of good roads.

"I think school might be dismissed for this afternoon,'' said the driver, severely.

Miss Whiting's role as a down-trodden tax-payer was the least bit embarrassing in view of this latest episode, and Beverly was not above enjoying her discomfiture and turning so good an incident to his own account.

The *Transcript's* columns presented daily evidence that this same subject continued to vex the public mind. The conservatives were confident that they would be able to defeat the Sycamore im-

provement and the progressives on their side were equally sanguine. The artist of the *Morning Vindicator*, the *Transcript's* rival, was brought into service, and views of Sycamore Boulevard as it would be were temptingly introduced to illuminate the text which was contributed voluminously. Beverly was a quiet but earnest worker in the cause. In the sanguine fashion of street-pavers he assumed that the improvement would win; and on this score he got all kinds of promises from the friends of the improvement that the Popocatepetl should build the street if anybody did.

Miss Whiting's five hundred feet of frontage were not forgotten, nor were that young lady and her orchid-loving aunt. Beverly was used to making estimates, and in the smoking room of the Mercantile club he had figured it out that a certain amount of time, if not a few paltry dollars, expended in interesting the elder lady of the Whiting house, would not be wasted in helping on the cause of good roads. An hour in the Eureka Public Library gave him some much needed light on the subject of orchids, and a telegram sent through a local florist to a neighboring city brought some specimens which, in the local slang, made him "solid." The cart came into play semi-occasionally and gave Beverly a good chance to expound the gospel of good roads with texts drawn from the highway. A small library of pamphlets found its way to the Whiting house, and this dissemination of literature was a subject for a good deal of joking.

Willoughby and his wife inspected a pile of it one evening when they had run in upon a discussion of municipal economy, intermixed with remarks on the habits of orchids, and they were moved thereby to some merriment.

"'Bev.' is a lively promoter," said the bridge-builder on the way home.

"And he seems to have taken up himself as an enterprise," added Mrs. Willoughby, at which Willoughby laughed again.

"I should say he was lively. Why, this is only his second week!"

The office of the board of public works was crowded. The fateful afternoon had arrived when the Sycamore avenue improvement was to be passed upon. In accordance with the Hon. Mike Malloney's scheme the whole thing was to be a mere matter of addition and subtraction. Although both sides had been diligent in getting

signatures, neither knew how much frontage the other represented. There were many non-resident property owners whose proxies had been sought, and in these lay an element of uncertainty. Beverly and Musgrave had been in session that morning, and after a good deal of calculation the Popocatepetl emissary had gone up into the Mercantile to meditate. After an hour's inspection of the spires and chimneys of the town he repaired to his room at the club and dressed himself for an afternoon call. A rare volume on "Orchid Culture," fetched from Boston, and a box of American beauties preceded him to the Whitings.

This was at two o'clock. At three Beverly appeared in the crowded rooms of the board of public works. Musgrave, exasperated by the cool appearance of the Bostonian, pounced upon him and dragged him into the hall.

"The jig's up," said the Major savagely. "The clerk is counting the frontage vote, but we're beat. I kept tab as the figures were read off, and we're certainly short by a small margin. It wont be four hundred feet either way."

"We might try this on if it's not too late," Beverly remarked soothingly. He put a piece of paper in the Major's hand.

"Late, h—l!" gasped the Major, reading the letter sheet at a glance. "We'll make 'em take it." He darted back into the room. Beverly paced the hall in some agitation and chewed a cigar. From the crowded office there arose in a moment a buzz which quickly became a cheer.

Beverly pushed his way into the door. A man by his side rested his toe tips to tell him that a five-hundred-foot vote had just been changed from the negative to an affirmative. The clerk was reading some figures while the crowd waited breathlessly. Some large totals were given which were unwieldly for mental computation. The clerk then added:

"The ayes have won by a majority of three hundred feet." And in the cheering that was now renewed the voice of the Bostonian was blended.

The *Transcript* issued an extra, and in completing his story the reporter wrote:

"It is said that Miss Whiting, whose changed vote threw the majority to the friends of the improvement, did so in the hope of facilitating a sale of her property."

Meredith Nicholson.

It may be that there is much truth in the old adage that the prophet is not without honor save in his own country, but the youngest of Indiana's literary men has won at home an appreciation no less friendly than the hearty one accorded him in other and older localities.

Mr. Nicholson is known chiefly as a writer of finished verse, yet he has by no means given himself wholly to poetry. Before he was twenty years of age, he had taken the first prize offered by one of the largest dailies of Chicago for the best short story tendered, and in the years since gone by, not many but with him well spent, he has given further evidences of his ability as a writer of prose. He is known in Indianapolis, where he makes his home, as an essayist of marked ability, and he is a prolific contributor of editorial matter to the Indianapolis *News*. There are but few of the better class of publications in which Mr. Nicholson's verse has not appeared. It is especially notable for delicacy of treatment and finish of style, and is as varied in kind as its author is versatile in talents. He has written sonnets showing a beauty of thought and depth of feeling such as might be expected only from an older man, and again he has sung lyrics so graceful and rythmic that one feels he is cheating his ear if he does not read them aloud. Charming as is his lyric muse, there are other and more serious emotions that call forth Mr. Nicholson's verse, and chief of them, it may be, is the religious. Much of the best of his work is of a devotional character and it is that, possibly, in which he takes greatest pleasure. He is a rapid worker, but remarkably pure in style, and both his prose and his verse bear the marks of scholarly thought and unerring taste. In 1891 he printed "Short Flights," a book of verse. Socially he is the most delightful of companions, and it can be truly said that his social side is circular.

CURRENT INFORMATION.

THE COMPETITION BETWEEN ASPHALT COMPANIES IN WASHINGTON—OTHER MATTERS.

WASHINGTON, D. C., July 20.—(*Special Correspondence.*)—Two interesting facts have been developed in the matter of the bids for laying asphalt pavements which were opened several weeks ago, and in which Thos. H. Thomas, of New York, made his entrance into the field hitherto monopolized by the Barber Asphalt Paving Company, brought down the price for doing such work, and became the lowest bidder for about $150,000 of asphalt paving.

It is about decided that the asphalt from Venezuela, to be used by Mr. Thomas on his work, is equal in quality to that obtained by the Barber Company from the island of Trinidad, and that the latter company has decided to make a legal contest of the power of the commissioners to give anybody a contract besides themselves, regardless of the character of the asphalt to be used in competition with them, or the price for which their competitor will do the work.

About a year ago Mr. Thomas, the present bidder against the Barber Company, submitted a sample of asphalt to the engineer commissioner, with a request that it be analyzed by the inspector of asphalt and cement. This was done, with the result that it was considered equal to the Trinidad cement in quality, there being points in favor of each which about balanced one another. The asphalt then analyzed was purer than that of Trinidad, which contains considerable vegetable and mineral matter. Its greater purity was a point then considered as against its value commercially, as it seemed to make it necessary to ship it in barrels instead of in bulk, as does the Barber Company.

Its softness involved considerable more expense in handling. The asphalt from Venezuela now offered by Mr. Thomas, samples of which were obtained from his works at South Amboy, N. J., by Capt. Fiebeger personally, have been but half analyzed, but this has been sufficient to identify it practically with that examined a year ago, and which proved thoroughly acceptable to the engineer commissioner then. There is little doubt that a complete examination will show the identity of the two.

Mr. Worthington, for the Barber Company, has notified the engineer commissioner that he wishes to present legal arguments against the letting of any contract for laying asphalt pavements in Washington to Mr. Thomas. His arguments have not been intimated, but there is little doubt that they will result in carrying the matter into the courts for settlement. The points to be urged by the Barber Company will probably be technical ones. The specifications of the Barber contract provide for a certain proportion of sand, stone dust and oil to be mixed with the asphalt, which was established in view of the character of the Trinidad asphalt. As that from Venezuela is purer, it will naturally follow that these proportions will have to be changed, and as a technical point the Barber

Company will claim that they must be adhered to.

The next specifications to be drawn up will, of course, provide against such an objection, but that does not help the present situation, which was unavoidable. A great number of points are to be argued by Mr. Worthington, all for the purpose of showing that the Barber Asphalt Company has a monopoly of laying pavements in Washington, in conjunction with the Cranford Company, which it controls.

A number of serious difficulties will be presented to the commissioners in disposing of the contracts to be made for asphalt paving. On the one hand they have encouraged the development of new sources of asphalt in the hope of bringing down the price established by the present monopoly, while on the other hand they feel that changes which involve any experimental conditions should be made cautiously. Companies engaged in public works look to Washington as a favorite field for introducing their materials and methods, as no other city in the country is so good an advertising field, and for this reason the contest for supremacy among the two asphalt companies is waxing hotter and hotter.

If Mr. Thomas proposed laying a small amount of pavement, which would do no serious harm were it to prove inferior to that of the old contractors, the commissioners would welcome without question the chance to test the work of a new bidder. But the work for which Mr. Thomas is the lowest bidder aggregates $150,000, and, lacking record of work performed, they will move slowly in replacing the old and tried by the new and untried.

Mr. Thomas claims to have laid a pavement in Detroit a year ago, which Capt. Fieberger will inspect shortly, though its newness prevents it from being a very reliable testimonial of the durability of the Venezuela cement and the methods used by Mr. Thomas. The latter will make a strong fight to secure the entire $150,000 of work, as the establishment of a plant here will be expensive, and it is probable that next year the competition between the two bidders will make it impossible to secure the prices now prevailing. But however the question is decided, the district will be the gainer, as bids are lower this year than ever before. Former efforts to break the monopoly of the Barber Company have been short-lived and ineffective.

Another source of good asphalt besides Trinidad and Venezuela, it is claimed, is the Island of Pedro Nellas, near Trinidad. The latter, however, has never been extensively worked, and, like all other sources of supply of the valuable paving material, is apt to fall into the hands of the Barber Company.

Since the foregoing was written the report of Capt. J. G. Fieberger, upon the Bermudez asphalt matter, has been submitted to Engineer Commissioner Powell. It gives a full account of his investigation of the Bermudez Company's plant at South Amboy, N. J., the street pavements laid by it in Detroit, and also the various tests to which the asphalt was subjected last week by District Chemist Richardson.

No recommendations are made by Capt. Fieberger as to the award of the contract for laying asphalt pavements, but he says that the Bermudez Company has complied with the intent of the specifications so far as the experiments and machinery are concerned.

It is understood that the commissioners are debating the advisability of rejecting the bids now filed

for this contract by the Barber Asphalt Company, the H. L. Cranford Company, and the New York & Bermudez Company, and to readvertise for proposals.

The ground upon which the commissioners propose to base their action is that the present bids are entirely too high. The representatives of the Bermudez Company regard this as an attempt to give them the cold shoulder, and declare that it is an indirect way to award the contract to the Barber Company, which would be able upon a readvertisement to materially underbid them.

The counsel for the Bermudez Company have called upon the commissioners, requesting a hearing before a conclusion is reached looking to a readvertising for new proposals.

The situation becomes more muddled from day to day, and the commissioners find themselves confronted with a problem which is not easy of solution. It is enough to say that both the Barber Company and the new bidders will contest every inch of the ground before a contract is finally awarded.

The district commissioners have awarded contracts for improving various streets, as follows: Fifteenth street, between East Capitol street and Pennsylvania avenue southeast, and Jefferson street, Anacostia, to Henry Naylor, and Champlain avenue, Massachusetts avenue extended, and other streets in Meridian Hill subdivision, to Andrew Gleason.

A charter has been granted by the corporation court of Alexandria to a joint stock company, formed under the name of "National Contracting, Building and Paving Company." This corporation was formed for the purpose of contracting for building houses, constructing and grading railroads and streets, for paving alleys, and for manufacturing artificial stone. It has a capital stock of $50,000, in shares of $25 each. The main office is in this city, and a branch office has been established in Alexandria. Officers for the first year are: President, Charles T. Moore, of this city; Vice-President, E. H. Campbell; General Manager, J. F. St. John, of Roanoke, Va.; Secretary, J. B. Johns, of this city, and Treasurer and Superintendent, T. O. Parker, of Roanoke.

Bids have been opened by the commissioner for furnishing the district with ordinary and repressed vitrified paving brick. The bidders were H. S. Hollywood, $18.45 per 1,000 for ordinary and $25.65 repressed; American Fire Clay Company, $17.85 for ordinary; J. M. Mack, $17 for ordinary and $17.95 for repressed, $19 for repressed patent brick, and $27 for repressed patent block; J. M. Hamilton & Co., $18 for ordinary and $19 for repressed; J. A. Hayden, $17.60 for ordinary and $18.85 for repressed; Glade Fire Brick Co., $16.45 for ordinary; State Line Fire Brick Co., $19.95 for ordinary; Frederick Brick Works, $11.50 for ordinary; McMahon, Porter & Co., $17.05 and $18.10 for ordinary, and $17.92 for repressed; Reed & Ettla, $17.37 for ordinary and $17.87 for repressed; the Shale Brick Exchange, $17.83 and $16.83 for ordinary and $18.83 for repressed.

The commissioners have annulled the contract of George F. Tichenor, for laying sidewalks, because of his failure to prosecute the work in a satisfactory manner.

NOTES.

There are in the District of Columbia a large number of streets that need resurfacing. Beginning with

the first day of July, the engineer department commenced work upon them, under the appropriation of $150,000 for the repair and resurfacing of streets. In addition to this work, the work of paving new streets for the next fiscal year involves an expense of $200,000. It will therefore be seen that Washington will put $350,000 into street improvement within the next twelve months.

One of the District commissioners, Mr. Ross, has heard of a new material used in the South for street pavements known as "chert." This material, he has been told, has been used extensively in paving the streets of Savannah, Macon and Atlanta, Ga., and also Montgomery, Ala. In order to receive full information concerning this new paving compound, he has written the mayors of those cities, asking for full particulars concerning it, and also for the cost of laying such pavements.

The readers of PAVING will doubtless recognize chert as a mixture of natural cement, limestone and flint, well rolled and watered. The dictionary's definition of the word, however, is "a sub-species of rhomboidal quartz." The chert used in the Southern cities between Montgomery and Savannah is a glassy slack, derived from the combination of the flux used in the blast furnaces of Alabama. In this country, to the south of the regions known in geology as "the drift," gravel is scarce and costly, hence the chert is a valuable substitute in road-making, and even for concrete. Having sharp edges and arrises, when broken up, it is a godsend for the shoe stores in places where it is used.

Thomas H. Thomas, of New York, has leased about 24,000 feet of ground from Littlefield & Alvord, close to their wharves, on which he will at once begin the erection of an extensive asphalt plant. It will consist of a series of brick buildings, which, with their equipment, will cost about $20,000. The machinery has been built by E. N. Gray, of this city. Mr. Thomas was recently awarded the contract for laying 21,000 yards of asphalt, and the plant he is to put up will enable him to carry out the contract.

The contract for furnishing the District government with 2,250,000 vitrified paving brick will be awarded to the Shale Brick Exchange, of Canton, Ohio. The various samples submitted by the bidders at the time their proposals were opened have been tested by a committee, composed of H. N. Moss, superintendent of streets, L. T. Boiseau, superintendent of property, and W. Donaldson, an inspector in the engineer department. The amount of money involved in the contract is $40,000.

In the report to Capt. Fieberger it was shown that for absorption the bricks submitted by the Ivy City Brick Company were the best, the percentage of absorption being .064. The Frederick Brick Company ranked third, with a percentage of .074. In the grinding test, however, the Frederick Brick Company ranked first, with a percentage of .449, and the brick of Childs & Son were second, with a percentage of .507. The Childs brick were fourth in the absorption test, with a percentage of .088. *A. I. P.*

SMOKE PREVENTION IN CITIES.

At the meeting of the Engineering Association of the South, Nashville, Tenn., July 13th, the subject of "Smoke Prevention" was presented by Prof. Olin H. Landreth, of Vanderbilt University. The pa-

per discussed successively the causes, the effects of smoke, and the remedies for it. Objectionable smoke comes mostly from bituminous coal, other fuels producing very little smoke. When fresh coal is thrown on incandescent coal there at once begins the distillation of the more volatile hydro-carbons, which distilled matter is burned if sufficient oxygen is present and the temperature is sufficiently high, but which otherwise passes up the chimney as yellowish fumes: As the fresh coal becomes more highly heated, the less volatile hydro-carbons are distilled, and are decomposed at a temperature much below that necessary for the combustion of the carbon liberated, about 2,000 degrees F., a temperature so high as to give considerable margin of opportunity for this portion of the carbon to escape unburned. It is this free unburned carbon in a finely divided state that, while incandescent, produces the luminous flame and, when cooled, the clouds of smoke that issue from the chimney and afterwards settle as soot. After the volatile matter is driven off, the fixed carbon remains, and in burning produces but little flame and no smoke, since the particles of carbon are not detached from the solid mass till combustion takes place. As to the effects of smoke production, the fuel loss in the smoke itself is but small, estimated at one-sixth of one per cent.; but the causes of smoke are also the causes of imperfect combustion and consequent waste of fuel in the form of invisible gases, carbonic oxide and light hydro-carbons, and the presence of smoke indicates this parallel waste. Aside from the fuel waste, the effects of smoke outside the furnace make its abatement of public interest. It is authoritatively stated that the residuum of smoke in the lungs induces consumption of an incurable character, and that in the city of Pittsburgh, Pa., the death rate was 1.62 per 1,000 lower during the eight years in which the use of natural gas almost freed the city from smoke, as compared with the preceding eight years; and that, since the partial return of smoke, the rate has increased 2.57 per 1,000. Carbon in a finely divided state is an easy vehicle both for noxious gases and organic impurities. The insidious soot pervades and defaces public and private buildings, and calls for fruitless efforts for cleanliness, when cleanliness is impossible. Smoke is objectionable from the loss of light and increased cost of artificial light; also from the repression of æsthetic tendencies and consequent mental and moral discouragement. * * * Consideration of the causes suggests the agencies and the mechanical devices for the prevention of smoke; these latter, so far as pertains to steam boilers, are classed as mechanical stokers, air flues in the walls and grate-bars, coking arches, dead plates, down-draft furnaces, steam jets for injecting air and mixing the gases, baffle plates and double furnaces. Smoke prevention must be accomplished by educating the public to consider smoke a nuisance that unquestionably can and should be abated, for the smoke producers are very slow to be convinced that this abatement is to their interest. Following the influence of public sentiment, laws are to be enacted, and provision made for their enforcement and for furnishing to smoke producers, when desired, professional advice regarding the means and appliances for smoke prevention. The paper gives the statutes passed in Chicago, Cincinnati, Cleveland, Pitts-

burgh, New York, Rochester, Boston, State of Ohio, and city of Birmingham, England, with statements of the success attained in preventing smoke in these localities, success in each case being proportional to the vigor of action taken. It also contains descriptions of various mechanical devices for smoke consumption, and closes with a list of literature on the subject.

The next meeting of the Association will be held Sept. 14th.

Walter G. Kirkpatrick, Sec'y.

STREET PAVING IN KANSAS.

E. C. Murphy has gathered statistics on the street paving of Kansas cities and towns, from which the following is compiled:

Supplemental to these statistics the city engineer of Atchison reports that he has abandoned the use of broken stone and has put down brick pavements on several old macadamized streets. He further says the cedar block pavement has proved a failure in this city and will be replaced by brick. The Bois d'Arc block pavement which has been down for six years on one of the principal business streets shows no signs of wear. It is expected to last twenty-five years.

Hutchinson, with a population of 8,682, has no pavement of any kind but is now covering a portion of the streets with cinders from the salt works.

	Miles Stone Block.	Cost per square yard.	Miles of Asphalt.	Cost per square yard.	Miles Wood Block.	Cost per square yard.	Miles Brick.	Cost per square yard.	Miles Broken Stone.	Cost per square yard.	Total No. Miles.
Kansas City	0.17	$3 00	1.02	$2 80	18.82	$1 50	1 00	$1 75	2.52	$0 87	23.53
Topeka	9.51	.....	11.00	2 80	2.16	.....	4 03	1 28 / 1 78	.....	.....	20.70
Wichita	1.00	2 45	2.33	2 80	.....	.....	0.38	2 03	.....	.....	3.70
Leavenworth	.....	.....	.....	.....	4 00	1 88	.....	.....	9.00	0 50	13.00
Atchison	0 04	1 44	.....	.....	1.96	1 90	3.33	1 65 / 2 00	2.42	0 60	* 8.30
Fort Scott	.....	.....	.....	.....	.....	.....	.....	.....	5.00	0 35 / UP	5.00
Lawrence	.....	.....	.....	.....	.....	.....	.....	.....	2.25	0 40 / 0 50	2.25
Hutchison	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Arkansas City	.....	.....	.....	.....	.....	.....	.....	.....	8.50	0 33	8.50
Emporia	.....	.....	.....	.....	.....	.....	.....	.....	1.50	.....	1.50
Parsons	.....	.....	.....	.....	.....	.....	.....	1 58	1.33	0 35	1 33
Pittsburgh	.....	.....	.....	.....	.....	.....	1 00	.....	.....	.....	1.00
Ottawa	†0 06	0 60	.....	.....	.....	.....	.....	.....	1.00	0 40	1.06
Salina	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Winfield	.....	.....	.....	.....	.....	.....	.....	.....	2.00	.....	2.00
Wellington	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Olathe	.....	.....	.....	.....	.....	.....	.....	.....	1.00	0 55 / 1 49	1.00
Total	4.78	.....	14.35	.....	26.94	.....	9.74	.....	36.52	.....	* 92.87

* Includes 0.55 mile of Bois d'Arc block pavement.

† Stone set on edge.

THE PAVING PROBLEM IN MINNEAPOLIS.

The Minneapolis *Journal* is devoting much space to articles and interviews on the subject of paving the streets of that city. Cedar block pavements can be put down there at a cost of from 85 to 95 cents a square yard, and there is strong sentiment in favor of the material, because it is so cheap that when renewed two or three times it will not be more expensive than the first cost of more durable kinds of paving. Below are the views of some Minneapolis citizens:

J. M. Bartlett.—"The present system of laying pine plank on the earth and placing the cedar blocks on the planks is a waste of every dollar the material costs. The life of a pine plank laid on the earth for a sidewalk is not more than five years, with only foot travel, and when laid under the blocks and kept damp on both sides in three years the heavy teaming begins to break it down, and in five years we all find ourselves driving off from paved streets and anywhere to reach our destination and keep off the pavement. You ask what I know about brick; would say, I spent a few days in Des Moines about three years ago and was favorably impressed with their brick paving; a few weeks since I again spent a few days there and looked the matter up more carefully. I found that city had made the same mistake we are making, and laid a large amount of cedar block pavement, and it was in the same or worse condition than ours. I was shown the first streets paved with brick in the city. After the brick were laid, the streets crossing the brick-paved streets were paved with cedar blocks. The cedar is entirely worthless and the travel is in the mud; while on the crossings where the brick were first laid it is seemingly as sound and smooth as when first put down. That settled the question with me. And again, the brick when first laid were not as well burned nor as skillfully put down as the work being done at the present time. There are miles of brick paving going in there this year, and cedar blocks could not be given to that city except for fuel."

J. C. Oswald.—"I have investigated street paving in Europe and in this country. While in London in 1874 I saw that the noisy stone pavements were replaced by the Nicholson pavement, which is a four-cornered wooden block set on edge on good, solid concrete foundation. In 1889 and 1890 I again visited London. I found them still laying the same pavement in place of the old-fashioned stone. And they laid the Nicholson in the same way as they did in 1874. The change was made more on account of the noise and also the cost. St. Paul has also made experiments with the wooden block pavement about eight or nine years ago, and some of it is still very good. Nor is the cost thereof very excessive. Here in Minneapolis we have had experience with granite, cedar blocks and asphalt, and it seems neither of them is faultless. The granite is very costly, noisy and exceedingly hard on horses' feet. Horseshoeing and sharpening of horseshoes is the cause that heavy teamsters seek to keep on a cedar block pavement and avoid granite. The asphalt pavement is much of an experiment in this city, but I think it almost too dry in dusty weather. Cedar blocks are an entire failure on streets where heavy teaming is done. But on residence streets and cross streets where heavy traffic can be kept away, there the round cedar pavement is a success.

The streets are always not too dry nor noisy, and can be kept clean. The life of cedar block pavement when used not too hard is between twelve and fourteen years.

"Two years ago, while in Lexington, Ky., I saw them lay vitrified brick for paving. I saw Lexington again last fall, and after investigating, found the brick streets in very good condition, and the city is well pleased with the change it had made.

"I have also examined the paving brick that is made in Galesburg, Ill. The cost is $8.50 at Galesburg, and laid down here in streets would cost $2.25 per square yard. I takes 105 brick per square yard. I have concluded to pave my driveway and inside walks around my residence with this vitrified brick, and am satisfied that the same will outlast cedar blocks, as it does not make much noise and is smooth. I hear some Galesburg parties are making some brick pavements in Winona, Minn. I also remember that at Cedar Rapids, Ia., two years ago, they were making vitrified brick pavements, and at my last falls' visit there I heard that the same gave good satisfaction. Taking everything together I think that brick pavement is the coming pavement, and the city of Minneapolis ought to make a trial."

J. K. Caldwell.—"My observations as to brick paved streets is confined to Galesburg, Burlington, Iowa, and St. Joseph, Missouri. In these cities vitrified brick have been used for some years, and meet with unqualified approval from the city engineers and street commissioners. I have given considerable attention to the proper material to make a good paving brick, and the proper method of making and burning the same. This is fundamental to good paving, and the report of the committee of one from St. Louis confesses this, as he admits the chief objection he discovered arose from imperfect making and burning; and imperfect material should be added.

"It should be remembered that the use of brick for paving streets is of recent date, in this country, at least. Hence it is not to be expected that perfection in the selection of material and the best manner of manufacturing could be reached at once, and this accounts largely for most of the defects in the oldest brick pavements in use. Perhaps the most prominent defects arises from imperfectly prepared foundations, allowing some portions of the roadway to sink more than others. But this defect is common to paving, whether of granite blocks, wooden blocks, asphalt or Telford, but this has no bearing as to the best paving material to be used.

"In the early days of the use of brick as a paving material, it was supposed that a street paving brick must be made largely of fire clay or semi-fire clay. Experience has proved this theory to be wrong. The material suitable for making a good paving brick must be such as to vitrify under a certain temperature in the burning process. What is here meant by vitrification is the changing the particles into a homogeneous mass, impervious to water and retaining nearly the hardness and toughness of iron. This fire clay will not do. If it did it would not be fire clay. The difference between a good vitrified paving brick and a brick made largely of fire clay may be aptly compared to the difference seen in the texture and grain of pig iron and wrought iron. The second primitive weak point in the manufacture of street paving brick arose from the want of suitable kiln or oven in which to burn

and anneal the brick, and all efforts to burn a good paving brick in such kilns as are usually employed to burn common brick in, have been failures. This defect in the manufacture of street paving brick has been very largely overcome by recent improvements in the style of kiln employed, but no system of making or burning will make a good paving brick out of unsuitable material. It seems almost certain that brick of the proper kind is the coming material for paving our streets, but care must be taken in the selection of good material—the preparation of a good foundation and reasonable care in the laying of the brick. For the paving of such business streets as Nicollet avenue or residence streets, there seems to be no material now before the public more suitable than vitrified brick on account of freedom from dust, noise, and the slipping or falling of horses incident to some other kinds of paving."

CHERT AS A PAVING MATERIAL.

The recent discussion in the United States Court, in the Central Railroad litigation, about chert as a paving material, has aroused the query in Savannah, Ga., if it could not be used for paving streets there instead of asphalt, graywacke or shells.

The engineering department has given the matter considerable attention and, after a careful investigation, has arrived at a conclusion favorable to it. The lowest price for asphalt in Savannah, per square yard, is $2.35, graywacke a little less and shells between 80 cents and $1. Chert can be laid in the streets, it is said, for 50 cents per square yard. When rolled and pressed, it is claimed that it makes a pavement more durable than shells, as pretty as asphalt, and with as much power of resistance as graywacke. It is a conglomeration of decayed granite and other stone material, and when rolled and pressed makes a durable and attractive road. An advantageous feature about chert is that the only bed it requires is a graded street or road. With a little judicious watering a few times a week the stuff hardens like sheet asphalt.

It is claimed that the shell pavements, on account of the rotting of the shells after about a year's use, have not come up to expectations, and for this reason the city will have to turn back to asphalt and graywacke to improve the streets unless a desirable substitute can be found. The substitute, according to those who claim to be authorities on the subject, has come in the shape of chert. This new material, instead of rotting by constant use, hardens and becomes more firmly knit together.

The engineering department is reputed to be anxious to give it a trial.

SEWAGE DISPOSAL WORKS AT BREWSTER, N. Y.

The town of Brewster, New York, is experimenting with a sewage disposal apparatus. The plant comprises a fifteen-horse power engine, a twenty-horse power boiler, a dynamo and two vats, one holding one thousand gallons and the other three thousand gallons. The frame structure on which the concern is placed covers an area of 23x30 feet. An iron cistern outside the building stores the water demanded for the steam boiler and other purposes. The vats in that building are used for the electro-chemical treatment of the sewage. One recepticle serves for the mixing of the chemicals with the deposit, from which a pipe conveys the compound to the other, in which there is a combination of

electrodes that agitates the mass and also conducts a current through the solution with the immediate effect of deodorizing, disinfecting and vaporizing the offensive accumulation. The action in the vat is similar to a violently effervescing spring. Mr. Wollf, the inventor, is enthusiastic respecting his method of germ destruction and deodorization of foul substances. He has been assured by prominent physicians that his discovery is destined to work a revolution in the treatment of parasitical diseases. He promises that Brewster shall have immunity to a marked degree from malaria, diphtheria and kindred afflictions.

A NOVEL SYSTEM OF RAPID TRANSIT.

A system of rapid transit interesting from its novelty from an engineering standpoint, if not for its feasibility commercially, has been devised by an italian engineer for the city of Naples. At present there is no satisfactory means of transit between the high level and low level sections of the city, and it is to provide this that the new line is projected. The line is to be carried on two metallic viaducts, each divided so as to form a double way, one for the operation of electric cars and the other for pedestrians. A masonry tower 325 feet high is to be built in the Via Roma, and from this the first viaduct, 1,180 feet long, will be carried to the Corso Vittorio Emmanuele, where it will terminate in the base of a metallic tower 490 feet in height. The second viaduct, 950 feet long and branching out of this tower some distance below the summit, will pass over the San Martino Hill and end in the ground level at the new Rione del Vomero. The viaducts will be carried on pyramidal metallic towers having masonry foundations; and the masonry tower at the beginning of the first viaduct and the metallic tower connecting the two viaducts will each be provided with staircases and capacious elevators for conveying passengers up and down. Passengers entering cars at either end of the line will not be compelled to change their seats on arriving at the metallic tower, as the cars will be automatically placed on the lifts for ascending to or descending from the highest viaduct, when the cars will continue their way to either terminus. Generating stations will be provided at each terminus for producing current for lighting and power purposes. A concession has been granted for the road.

FRESH FROM THE PRESS.

The second annual message of Edwin S. Stuart, mayor, and the report of James H. Windrim, director of public works of Philadelphia, have just been printed. They make a volume of ninety pages, and review in detail the public work of Philadelphia, which has been conducted with conspicuous success under the management of Mr. Windrim.

A neatly printed volume of seventy-five pages freely illustrated, entitled "Twenty Years' Practical Experience of Natural Asphalt and Mineral Bitumen," by W. H. Delano, general manager of the Campagne Generale des Asphaltes de France, has just been issued. It is intended as a popular exposition of asphalt, as well as a treatise on its uses and abuses. It also embodies general observations of value on the care of streets. The publishers are, in London, E. & J. Span, 125 Strand, and in New York, Span & Chamberlain, 12 Cortlande street.

The Drake Technic is the title of the first number of a publication issued under the auspices of the Engineering and Scientific Society of Drake University, of Des Moines, Iowa. It comprises a hundred pages of contributions on technical subjects from students of the University. In substance and appearance the first number is very creditable.

The sewerage commissioners of Brockton, Mass., Messrs. R. P. Kingman, H. A. Monk, A. C. Thompson and City Engineer Herbert Snow, have printed their report on the system of sewerage and sewage disposal proposed for Brockton. It shows thorough consideration of the problem, and is a valuable contribution to the literature on the subject.

An official report of the affairs of Canton, O., has just been issued, which, in its way, is somewhat novel. It combines with the reports of city officers a review of the social and commercial growth of Canton, written by Archibald McGregor, and articles upon the various business interests of the city, all elaborately illustrated with half-tone pictures. The volume comprises 170 pages, and is issued under the direction of Wm. Lichtenwalter, city clerk. The report of L. E. Chapin, city civil engineer, is devoted largely to the new sewerage system which has been constructed there under his directions. The report shows Canton to be a remarkably progressive city. It has been in the lead in brick street paving, of which it now has about twelve miles, put down at a cost of from $1.67 to $1.71 a square yard.

A. S. Cooper, city engineer of Superior, Wis., in his annual report states that the paving in Superior has up to this time all been of six-inch cedar blocks on two-inch plank. He thinks it well that it has been of a temporary nature, on account of the unsettled condition of the streets, nearly all of which have been opened, graded and drained within a few years, and they will necessarily be disturbed a great deal by being opened for water, gas and sewer connections during the rapid growth of the city. He recommends a system of continued paving and parking. Aside from the beauty of the parking, it would reduce the expense of street paving about one-fifth.

PERSONALS.

E. M. Capps has been appointed city engineer of San Diego, Cal.

C. S. Gamble has been elected city surveyor of Muskegen, Mich.

Mr. Fred. C. Williams, of Tonawanda, N. Y., has been appointed sanitary engineer, Cleveland, O.

Mr. Lincoln C. Heywood has been elected town engineer of Lincoln, R. I., and is to pay particular attention to the highway department.

W. E. Nickerson and Edward Cary, both of Boston, have been issued patents, four to the former, and one to the latter, on an incandescent lamp, which will be in the market shortly.

SELECTIONS FROM THE PRESS.

CLAY FOR CEMENT MANUFACTURE.

The so called alluvial clays found along the banks of the Thames and Medway rivers are extensively employed in the manufacture of Portland cement. Selected examples of the clays have been subjected to many analyses, from which the following has been selected:

No. I, by Feichtenger; No. II, Faraday; and No. III, recent.	I.	II.	III.
Silica	68.45	64.72	70.56
Alumina	11.64	24.27	14.52
Lime	.75	1.89	4.43
Oxide of iron	14.80	7.14	3.06
Soda and kali. Soda, 2.90 Potash, 1.10	4.00	.....	3.95
Carbonic Acid	.....	.....	3.48

The fine clay found along the banks of the Thames and Medway early became an object of considerable value to the cement-maker, from the facility with which it can be amalgamated with chalk, and continues to be largely used by the cement-makers whose works are situated on the banks of the rivers named. In the condition in which the clay is excavated, it contains a large amount of moisture, averaging about one-half its gross weight. The deposits are of varied character, consequent upon the condition of the water during the period of precipitation of the clay; in calm weather during neap tides the best conditions prevail for the deposition of the finer particles, and during spring tides and high winds, the coarser parts of the wasted shores of the rivers are precipitated from their waters of solution.

For blending with amorphous carbonate of lime (chalk) the alluvial clays are very suitable, and during the first forty years of the "Portland cement period" commanded the sole attention of the manufacturers. Their capacity of easy and simple conversion to the required purpose led, however, to a haphazard system of manufacture, and a total disregard of the chemical elements of the process, which defects have of late been remedied.

The mixtures of clay and other material from which cement is made, are reduced to powder by any suitable arrangement for impalpably pulverizing the dry substances. The kind of machinery required for this purpose will greatly depend on the system pursued. By the wet method the wash-mill treats the raw materials so as to fit them for the succeeding operation of drying and burning. The dry method requires the assistance of stone breakers, triturators, or other reducers, before the raw materials can be rendered suitable for the process of dessicating or burning. From this point the machine treatment of the resulting clinker is common to both the wet and dry systems.—*British Clay-Worker.*

PETRIFIED PAVEMENTS IN TEXAS.

A discovery of probably great archæological value, as regards the prehistoric people of the United States, was recently made on the farm of H. Richwalls, twenty-five miles southwest of Decatur, in Wise county, Texas. It consists of a pavement of petrified wood, covering the summit of a mound one and a half acres in area. Samples of the pavement were brought by D. M. Garvin, of Cleveland, O., who made the following statement regarding the discovery:

"The mound is sixty feet high, square-shaped, and with sloping sides. It was looked upon as an ordinary clay structure until a short time ago, when, in digging

the soil on the summit, which is level and measures an acre and a half, a petrified pavement was struck upon what appeared to be a shallow deposit of drift. Further explorations showed that the entire summit of the mound was paved.

"The petrified blocks were laid on the ends as compactly as a Nicholson pavement. In places the pavement is perfectly smooth, while in other places, owing to the depression that the soil has undergone during the ages, it is irregular. The mound, which was constructed with mathematical precision, also contains some blocks of stone that seem to have been used in a building." The samples of the pavement are four inches long, and undoubtedly are petrified wood.

Three inches of their length is silica and the remaining inch, measuring to the wearing surface, is carbonate of lime. This combination, which is not uncommon in petrifactions, shows that the pavement was probably set in silicious sand and that the upper part was subjected to the action of water containing lime in solution. The blocks give evidence of having been split by a sharp instrument and sawed at the upper surface.

While thousands of mounds have been discovered on this continent, this is the only one in which, through the agency of petrifaction, nature has embalmed an evidence of a place in civilization occupied by the mound builders far in advance of what has been accorded them by antiquarians. — *Dallas (Tex.) News.*

MATERIALS FOR STREET PAVEMENTS.

Never before has the subject of street paving received so much attention as at present. The item of street paving forms such a large feature of expense in the average municipality that the tax-payers feel desirous of getting the worth of their money when extensive paving improvements are contemplated. Taking a retrospective view of the evolution in street paving during the last quarter century, it seems that as much progress has been made during this period in the paving of streets and roadways as during the entire period of the world's history theretofore.

Twenty-five years ago we knew nothing of asphalt pavements, bricks for street paving were unknown, and even the cedar blocks had not been discovered. In fact, all the desirable materials used for street paving in these days were utterly unknown then. The art of street paving may be said to have started anew in the Seventies, but the improvements in road-making since those days have been truly wonderful. The macadamized roadway, the invention of a clever Scotchman, had been used some years when an erratic genius promulgated the idea that oblong blocks of wood would make a pavement which promised to revolutionize street paving and immortalize the inventor.

Before the American public awoke to the fact that wood blocks made about the most worthless of street surfaces, a number of our cities had spent aggregately several millions of dollars in this sort of paving. Then somebody found out that cedar blocks would last longer than blocks of pine, and circular cedar blocks were used quite extensively with some degree of success. With the rapid abandonment of the wood pavements the tar and gravel pavements became popular for a time, but there was such a vast amount

of patching and general repairing to be done that the people soon sickened of them.

Then came the smooth and incomparable asphalt pavements which still have the call. Hundreds of miles of asphalt pavements were soon in use in Washington and Buffalo and nobody has been able to find any serious fault with them, except to find that they retain the heat in summer to a remarkable degree, and they are the most expensive of street pavements.

The great competitor of asphalt during the past two years has been vitrified brick, and the popularity of vitrified brick as a paving material is only surpassed by asphalt. Vitrified brick pavements have grown in popular favor quite as rapidly as any of its predecessors. One of its greatest advantages over asphalt is that it is a cool pavement, brick not retaining the sun's heat any more than the earth of which they are made. The comparative cheapness of brick is another great point in their favor and a part of a brick pavement can easily be removed for making excavations, etc., and replaced without marring the beauty of the street surface. Interesting encounters have occurred in several cities recently where the asphalt companies came into collision with the brick manufacturers. At Des Moines, Ia., recently the common council was almost equally divided between asphalt and brick, and the whole city was more or less agitated over the matter.

The vitrified brick has come to stay. While it is inferior to asphalt in making a smooth roadway, it is superior to the latter in warm weather and in warm climates where a net work of asphalt streets in a city will help to keep the thermometer in the eighties through the night.

The Central West was first to use vitrified brick pavements to any extent. About all cities and towns in Ohio have them, and Illinois is well to the front.

The writer has talked recently with paving brick manufacturers in Ohio, Illinois, New York, Iowa, Nebraska and Missouri, and many of them report that they are unable to turn out brick fast enough to keep pace with the demand. Plants are being enlarged and the monthly outputs are being rapidly increased. It is apparent that the paving brick business is in a thriving condition and we bespeak for the enterprising manufacturers a steady increase in their business. — *American Contractor.*

TO MAKE A GOOD BRICK.

In order to make a good brick, either plastic, semi-plastic, dry-pressed, semi-dry, hand-made, or any other kind of brick, the clay should be properly prepared. It should be ground very fine, whether it be ground first, dried, and then tempered with water, or whether it be ground with water; the finer the clay is ground the better the brick will be. There is a good deal to be said against dry-pressed brick, but in the majority of cases where dry-clay brick have been found to be a failure, one of the reasons for the lack of success in their manufacture will be found in the clay not being properly ground.

If a good hand-made brick is desired, prepare the clay, make it smooth, work the clay thoroughly, and let the proprietor see for himself that it is prepared. In clays not ground properly, dry lumps of clay in the brick cause it to break and burst. This is proof that the clay must be properly prepared.

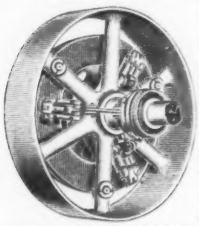
It is better to take the clay out in the autumn, and let it be exposed to rain and frost during the winter. By so doing, it is possible to burn brick sixpence to a shilling per thousand cheaper than if the clay is taken fresh from the bank.—*British Clay-Worker.*

MACHINERY AND TRADE.

AN IMPOVED FRICTION-CLUTCH PULLEY.

An improved friction-clutch pulley, called the "Imperial," manufactured by J. W. Penfield & Son, of Willoughby. The pulley has a novel form of construction which, it is claimed, secures increased efficiency, durability, ease of adjustment and quickness of repair, overcoming the only valid objections heretofore urged against friction-clutch pulleys in general.

The clutch mechanism of the Imperial pulley may be briefly described as follows: The pulley is provided with two circular friction rings between which is a friction disc. The friction disc is keyed to the shaft and turns with it, while the balance of the mechanism and pulley is loose on the shaft. The clutch-levers clamp the friction disc between the friction rings, thereby setting the pulley in motion. The clutch mechanism is very positive and quick acting, giving immediate control over the pulley.

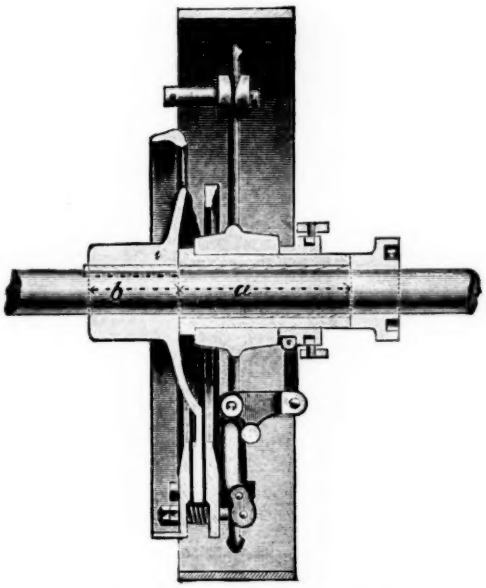


PENFIELD'S IMPERIAL CLUTCH PULLEY.

The friction surfaces of the friction rings are protected by strips of insulated fibre, according extra precaution against wear. These strips can be replaced at any time. The bushings are made in halves, and renewable. They are babbitted, and can be removed and rebabbitted at any time without taking the pulley from the shaft. As the friction surfaces and bushings are the parts subject to greatest wear, the construction of the Imperial pulley, permitting the renewal of these parts readily, enables the user to keep the pulleys in perfect repair and running order.

The advantages of equipping the line shaft with clutch pulleys are well known and appreciated. By this arrangement the belts stand still when not at work, avoiding wear and tear, and also saving the power which would be required to keep loose pulleys and belts in motion. The only valid objection, heretofore, has been that if a friction-clutch pulley on the line shaft should slip and need adjustment, the entire line of shafting would have to be stopped for that purpose, or the pulley would have to be thrown out of clutch, losing the work of the machine it was driving until the shaft could be conveniently stopped and the friction of the pulley increased. This objection has been entirely overcome by the Imperial Clutch Pulley. Owing to its manner of construction, the friction disc is the only part of the pulley that is in motion when the pulley is out of clutch, the clutch mechanism and the balance of the pulley being loose on the shaft. Therefore, should an Imperial driving pulley on the line shaft slip at any time, the pulley can be thrown

out of clutch and the adjustment of friction effected without stopping the shaft. This feature is of decided advantage to any establishment permitting the constant and continuous motion of the line shaft.



SECTIONAL VIEW OF IMPERIAL CLUTCH PULLEY.

The Imperial Clutch Pulley also enjoys freedom from injurious effects due to centrifugal force. The resistance is in direct line with the strain, and consequently centrifugal force does not exert a twisting strain upon the clutch members nor throw them out of balance. As the friction rings move parallel to the shaft, centrifugal force can not accidentally throw the pulley in or out of clutch. The permanent balance of the clutch mechanism and pulley being assured and centrifugal force having no effect on the action of the pulley, there is apparently no limit to the speed at which the clutch may safely be driven.

The large friction surfaces and the manner of applying the friction make the pulley very positive and reliable in action, and it will transmit all the power exerted by a belt of the size for which it is made.

The Imperial Friction Clutch Pulley is free from complicated devices, has few parts, occupies comparatively small space on the shaft, is light running and powerful. The fact that it combines all of the essentials of a first-class pulley, with freedom from difficulties heretofore encountered with other makes, should make it a most attractive appliance and ensure its widespread adoption.

NOTE.

The latest trade publication, from J. W. Penfield & Son, of Willoughby, Ohio, is entitled "*With the Brick-Makers,*" being an account of experiences with Penfield Auger Brick Machinery. Twenty testimonial letters from paving brick, sewer pipe and tile manufacturers, regarding the merits of these machines, are set forth in attractive form. The pamphlet will be mailed to any one on application to J. W. Penfield & Son, Willoughby, Ohio.

IMPROVEMENT AND CONTRACTING NEWS

PAVING.

Main street, in DuBoisham, Pa., is being paved with cobblestone.

Street improvements of vitrified brick are being made in Louisville, Ky.

Legislation has been started in Toledo, O., for the paving of Oak street, from Front to Pearl street.

Thirty thousand dollars has been appropriated for the repair of public roads by the County Board of Freeholders, Camden, N. Y.

The paving of Blake street, Denver, Colo., is acknowledged to be the best, in stone, in that city. The surface is as smooth as asphalt.

Five and a half miles of paving will have been completed in Ashland, Wis. by the middle of October. When complete, there will be seventy-eight blocks.

The property owners on Sterling street, between Main street and Ninth avenue, East Orange, N. J., have petitioned to have Sterling street macadamized and curbed.

One thousand feet of brick paving has been done in the city of Franklin, Pa., under the supervision of city engineer T. L. Kennendale. About 246,000 brick were used.

The letting of several street improvements has been postponed in Richmond, Ind., pending a possible reconsideration of the appellate court decision on the Barrett Law.

The city commissioners at Elkhart, Ind., have been doingsome good work this season, by graveling the streets and then rolling with a seven ton roller. The results have proven good.

If successful in obtaining judgment against abutting property owners on lines of proposed street improving, Moline, Ill., will have eighteen blocks of paving constructed this fall.

Rome, N. Y., voted for a steam roller to be used upon the streets, and adopted resolutions to favor the reception and operation of a stone crusher to be presented the city by the cyclers and citizens.

An election held in Seymour, Ind., determined the question of building four gravel roads to the township line, which will give the city six gravel roads leading in different directions. The cost of the roads voted on will be $40,000.

The hard roads at Dixon, Ill. are completed. They were made by putting crushed stone in the center to a depth of ten inches, and at the sides to a depth of six inches. A finer material was placed on top and rolled in to make it hard and smooth. Two miles of valuable road was built at an expense of less than $2,000 a mile.

CONTEMPLATED WORK.

Saline, O., contemplates making improvements in her streets this year.

A stone sidewalk will be constructed along the north side of block 25 in Eldorado, Kansas.

The common council, Schenectady, N. Y., voted to grant the petition to pave Jay street with block asphalt.

South Bend, Ind., will build brick pavements on Vistula avenue and Laporte avenue, amounting to 20,000 yards.

The mayor and council of Deadwood, S. D., have resolved to grade, macadamize, curb and drain Main, Sherman, Charles, Wall, Lee, Deadwood and Pine streets.

Van Wert, O., has advertised for 1,200 feet of curbing for Jefferson street, and will soon advertise for 4,000 feet more. Two squares of Water street will be macadamized at once.

The common council of Crawfordsville, Ind., is discussing the proposed purchase of a steam road roller to be used in compacting freshly graveled roads.

An ordinance has been passed in Lockport, N. Y., by the common council to pave Mulberry street, nearly one mile long. Two petitions are being circulated, one by Main street people, to pave with brick, and East avenue people, to pave with block stone.

River street, Detroit, Mich., from Seventh to Twelfth will be repaved with cobblestone on concrete foundation. The work will be done as an experiment, as this street is used largely for heavy traffic, and the board of public works believe the paving selected the best adapted for the use to which it will be applied.

The tax commissioners of Hoboken, N. J., have appropriated money for the improvement of Newark street, between Willow avenue and Jefferson street; Grand street, between Newark and First streets, and First street, between Jackson and Marshall streets, by repaving with Belgian block pavement.

Commissioner of public works, Michael T. Daly of New York, reported that he had $311,900 balance out of the special appropriation of $1,500,000 which he will use in repairing streets this year, one with asphalt on macadam foundation, one with granite on concrete foundation, and the others will be repaved with asphalt on their present foundation.

CONTRACTS TO LET.

Bids will be received until August 15, for curbing two streets with stone at Danville, Ill.

Bids are invited until August 23, by L. E. Harter, city engineer of Warsaw, Ind., for constructing sidewalks.

Proposals will be received until twelve o'clock Monday, August 7th, for improving Sixteenth street, Columbus, O.

Bids will be received at the office of the board of administration, Cincinnati, O., until August 11th, for the improvement of Hollister street and Ingleside avenue.

Sealed proposals will be received at the city clerk's office, Rock Island, Ill., until Monday, August 7th, for the improvement of Seventeenth, Nineteenth and Twenty-third streets.

North Washington street from the north end of the river bridge to the north line of West Davis street in Tiffin, O., will be paved. Sealed proposals will be received until August 4th.

Bids will be received by Sylvester Lamb, city clerk, Toledo, O., until twelve o'clock, August 7th, for improving Sixteenth from Washington to Adams street, also Galena street and Lincoln avenue.

Bids will be received by the common council of the city of Lafayette, Ind., until August 14th, for the improvement of the alley from Third street to Fourth street and between Main and Ferry streets.

Bids will be received by city engineer Burson, Streator, Ill., until August 7th, for 86,495 square yards of brick paving, 44,740 lineal feet of stone curbing and 26,958 cubic yards of grading. Estimated cost, $175,314.

Bids will be received in the mayor's office, in the city of New Albany until August 7th, for the improvement of the alleys between Spring and Elm streets, between West and Thomas, between Oak and Sycamore and between East Eleventh and Fifteenth streets.

J. J. Malley, city clerk, Defiance, O., will receive bids until August 10th, for the improvement of East Hopkins street, between Ottawa avenue and Auglaize street, and for that part of Hopkins, Jefferson and Fifth streets, extending from Francisco street to the canal bridge.

Bids will be received at the office of the city clerk, Chas. H. Goodwin, Terre Haute, Ind., until August 15th, for the improvement of Second, Third, Fourth, Eighth and Ninth streets from Cherry street to Ohio street and Fifth and Sixth streets from Cherry street to Wabash avenue.

CONTRACTS AWARDED.

Carthage avenue, Norwood, O., is being improved. Charles Brinkmyer was awarded the contract.

One mile of macadamized street, 40 feet wide, with curbing for same, has been sold at Delphos, O.

A contract for one mile of brick pavement has been awarded Bick & Glann, at Galesburg, Ill.

Ryan & Burke, Alton, Ill., were awarded the contract for paving Short, Belle, Fourth and East Second streets.

Jacobs & Stewart, of Norwalk, O., are paving Market street, between Wayne and Jackson streets, Sandusky, O.

E. E. Rutledge, civil engineer, at Venice, Ill., is constructing a vitrified brick street at an estimated cost of $32,000.

Wm. H. Raymond and H. E. Baker, of Galion, O., were awarded the contract for paving the street of Mt. Gilead.

Homer & Co., Olean, N. Y., received the contract for the improvement of Main street, in Hornellsville, N. Y., at $55,216.

The contract for grading, draining and improving Glenwood avenue, Youngstown, O., was let to John Kane of that city, at a cost of $6,098.

E. T. Smart, Seattle, Wash., was awarded the contract for Light street, at a cost of $2,482.50, and J. A. Bailey was given Lewis street at $7,095.75.

The Rosetta Gravel Co. was awarded the contract for paving Patterson street from Lavergne to the Southern Pacific Depot, with concrete gravel.

The T. B. Townsend Brick and Contracting Company of Zanesville, O., secured the contracts for improving Main and Fayette streets in Washington, O.

Henderson, Ky., awarded to John Haffey of that city, the contract for delivering 5,000 cubic yards of limestone macadam to be used in street building.

Franklin, Pa., has under contract now 800 feet of street paving with brick. R. A. Bigley of that city was awarded the work at 98 cents per square yard.

Milton & Pierce of Litchfield, Ill., have been awarded the contract at Carlinsville, Ill., for constructing 11,000 square yards of two course brick pavement at $1.55 per square yard.

The Warren-Scharf Asphalt Paving Co. was awarded the contract for repaving the lower end of Woodward avenue, from the opera house crossing to Jefferson avenue, Detroit, Mich.

Hallane Bros. were awarded the contract for about three-quarters of a mile of vitrified brick paving of a portion of the streets of Connellsville, Pa. The price received will be between $40,000 and $50,000.

Main street, from Fourth to Sixth and from Ninth to Twentieth, Richmond, Ind., has been let to the Standard Paving Company, Detroit, Mich. Bids include five by twenty Berea curb on Canton repressed including oolitic curb.

The Standard Construction Co. of Columbus, O., was awarded the contract for paving Main street, in Fostoria, O., for $18,266.70, the work to be completed by the first of November. East Clayton paving block was chosen for the work.

Peter Manigan secured contracts for paving six streets in Memphis, Tenn.: Linden, at a cost of $4,088.40; Pontotoc street, $1,787.33; Pontotoc east of Wellington, $3,176.57; St. Martin, $8,787; Main street, $3,625; Mill street, $3,325.

Newport, Ky., recently awarded contracts for the paving of various streets. Fourth St. with Metropolitan block, was awarded John Trapp at his bid of $31,935.50; Isabella street, between Fourth and Ninth, awarded J. M. Peter, Hallwood block, $31,166; York street, between Third and Eighth, awarded Standard Construction Company, Porto block, $37,565; Washington avenue, between Third and Eleventh, Chas. Spinks & Son, Grand Star block, $64,503; Ninth street, between Mill and Overton, John Trapp, Macadam, $22,804.

The following contracts for street paving have been let in Syracuse, N. Y.: With Trinidad street asphalt, Onondaga avenue, 5,980 square yards, $19,115.56; Holland street, 2090 square yards, $7,498.00; North Salina street, 32,850 square yards, $106,112.70; Furman street, 4,670 square yards, $14,526.70; East Onondaga street, 7,330 square yards, $23,217, awarded the Syracuse Improvement Co.; with vitrified paving brick, Tallman street, 4,780 square yards, $12,638.20; Sabine street, 3,555 square yards, $9,347.20, awarded Jno. M. Mack & Co.

SEWERAGE.

Brewster, N. Y., is experimenting with a new sewage disposal apparatus.

Emporia, Kan., has 26,800 feet of sewer, which nearly completes their separate system of sanitary sewerage. It is the only exclusive sanitary system adopted and completed in the state.

The common council sewer committee in Troy, N. Y., reported favorably on sewers for seven streets.

Sewage disposal works have been completed at Huddersfield, Eng., costing about $345,000. Eight million four hundred thousand gallons of sewage can be treated daily.

The cost of the extension to the main sewer outlet, which will carry the sewage to the city limits, in Denver, Colo., is roughly estimated at $250,000. The work will extend from Twenty-eighth street to beyond Fortieth, and will, practically, follow the river.

The estimated cost of the sewage and storm-water disposal of Orange, N. J., which was commenced in 1891, was $500,000. Some changes in the original plan and the encounter of many local difficulties an addition of 300,000 extra was expended and about 175,000 more is needed to complete the system.

CONTEMPLATED WORK.

Cortland, N. Y., recently voted in favor of a sewer.

Bridgeport, W. Va., contemplates a system of sewers.

Galesburg, Ill., contemplates 3,500 lineal feet of sewers.

Moline, Ill., will have 7,000 feet of public sewers this fall.

Victoria, B. C., proposes more additional sewers for the city.

Martin's Ferry, Ohio, will sewer Walnut street by laying a main sewer pipe.

A short line or two of sewers may be constructed soon in Crawfordsville, Ind.

Sewerage of 11,200 feet, 24 to 90 inches in diameter, will be constructed in South Bend, Ind.

The sewer commissioner at Lambertsville, N. J., is earnestly working for a system of sewers.

A system of sewers will be established in Middletown, Pa., by the Middletown Drainage Company.

A sewerage system, to cost in the neighborhood of $40,000 is contemplated at Saranac Lake, N. Y.

An ordinance has been passed at Litchfield, Ill, to build a brick sewer, which will cost about $12,000.

Plans will soon be completed for a brick sewer 5,600 long, to be built this summer at Richmond, Ind.

The board of public works, Jamestown, N. Y., have received bids for a large section of sewers to be constructed on the south side of the outlet.

Belfast, Me., contemplates a system of sewerage, for which proposals have been received from Dacey and Taylor, of Boston.

The board of public works, Detroit, Mich., contemplates the building of a public sewer on Pallister avenue, from Woodward avenue to Russell street.

The sewer question at Delphos and Van Wert, Ohio, while dropped for the present, will be taken up again. Preliminary surveys and estimates have been made.

Findlay, Ohio, will construct main sewer No. 6, extending from its intersection with main sewer No. 1 at Corwin street, westward to Franklin avenue, north to Howard street, thence west to Morey avenue.

The common council of Schenectady, N. Y., voted to construct an outlet sewer to take the sewage from the upper part of the city, and thus relieve the sewers in the lower part of the city. It will be about 7,000 feet long and will empty into the river below the city.

Preliminary estimates for sewers have been ordered at Syracuse, N. Y., as follows: Four 18-inch tile sewers amounting to 3,800 lineal feet; ten 15-inch tile sewers, 5,740 lineal feet; one 12-inch tile sewer, 795 lineal feet; one 36-inch brick sewer, 1,600 lineal feet. These sewers will require about 8,500 lineal feet of 6-inch tile for house connections to the curb lines, and will be ready for letting about Sept. 11.

CONTRACTS TO BE LET.

Bids are invited by the city engineer of Ft. Wayne, Ind., until August 3, for constructing a sewer.

The city engineer of Goshen, Ind., will receive sealed bids until August 14, for laying a lot of fifteen-inch sewer pipe.

Sealed proposals will be received by the board of sewer commissioners of the village of Clinton, N. Y., until August 3d, for constructing sewers in said village.

Sealed proposals will be received by the city clerk of Wooster, Ohio, until August 11, for the building of a twelve-inch clay sewer pipe on Bealle avenue, from Liberty street to University street.

CONTRACTS AWARDED.

The Van Trees street sewer, Warsaw, Ind., has been awarded Brown Bros., at a cost of $8,600.

Four thousand lineal feet of vitrified pipe sewers have been let at Galesburg, Ill., to Bick & Glann.

Jaynes & Rank were recently awarded the contract of a public sewer on Lothrop avenue, Detroit, Mich.

Ayers & Kummerland, Kearney, Neb., have the contract for 3,500 feet of 6 and 8 inch sewer in that city.

The contract for constructing sewers on Deerfield street and Bay State road, Boston, was awarded Dennis O'Connell.

A 10-inch pipe sewer, on Commercial avenue, Binghamton, N. Y., was let, July 10th, to William Conklin for $1,154.90.

The construction of a sewer on North Sixth street, Sheyboygan, Wis., was awarded to Wm. Schaetzer, a local bidder.

Henry Schuck was awarded the contract for the construction of a stone-arch sewer, inside dimensions, 6 by 8 feet, at Hazleton, Pa.

At Youngstown, O., the Clarke street sewer was awarded S. King, at a cost of $259.50. Edward street sewer was awarded F. E. Gribbon at a cost of $784.50.

H. Ward, Binghamton, N. Y., writes that two pipe sewers were let to E. A. Matthews, last week. One on Seminary avenue for $923, and one on Gifford street for $487.

The contract for building an extension to the storm water sewer, Fort Smith, Ark., was awarded the Water Works Plumbing Co., of that place, July 6th, the work to begin ten days from that date.

B. R. Morton, city engineer of Newport, Ky., writes that contract has been awarded to O'Brien & Mannon for cleaning and keeping clean the catch basins of sewerage system at $1.45 each per month.

The contract for a new sewer system of St. Joseph, Mich., was awarded Denler & Scott, of Port Huron, at a cost of $16,477.90, including 50 catch-basins and 50 man-holes. The work is to be completed by November 1.

The contract for the State street sewer, New Haven, Conn., was awarded Patrick Dowling at a cost of $8,100.50. Lawrence O'Brien was awarded the contract for a sewer on Water street, from Union to State, at a cost of $1,825.50.

Belfast, Me., has contracted with Charles Baker, of that city, to build about 1,850 feet of sewer at the following price: Excavation and back filling, 30 cents per lineal foot; ledge, $5.50 per cubic yard; man-holes, complete, $75; laying pipe, 5 cents a running foot. Pipe to be furnished by the city.

Bids were received and contracts awarded on the following pipe sewers at Saginaw, Mich.: Michigan avenue, from Genesee avenue to Houghton avenue, Chas. Koch, $1,497.50; Michigan avenue, from Clinton street to Court street, Kelley and Laloule, $1,664.50; Michigan avenue, from Miller street to Houghton avenue, Jno. C. Davis, $3,826.75; Whittier and Fourth streets, from Genesee avenue to Holland avenue, Chas. Koch, $925.85.

WATER-WORKS.

The city of Moline, Ill., has purchased a 5,000,000 gallon Dean pump.

The water supply at Bethlehem, Pa., is again an interesting topic.

The water-works question is an absorbing one in Columbia City, Ind.

The standpipe is about all that the new system of water-works lacks of completion, at Athens, Ga.

Col. W. W. Taylor, builder and owner of the Cannelton, Ind., water-works, has tested his plant, and it has proven satisfactory.

Elkton, Md., pronounces the water-works system not only a great improvement and success, but a paying investment as well.

Mr. C. C. Morgan, a civil engineer of Chicago, has been employed under contract to superintend the construction of a water-works plant at Macomb, Ill.

The board of water-works trustees of Dayton, Ohio, has adopted a meter system whereby consumers pay for the water actually used, and much satisfaction is reported.

The water-works trustees of Canton, O., have signed a contract with the Holly Manufacturing Co., by which a new pump will be placed in the station which will insure a capacity of seven million gallons daily.

The Massachusetts State Board of Health has been directed to report on a metropolitan water supply to provide for Boston and its suburbs within a radius of ten miles from the State-house, and for such other cities and towns as should be included in the scheme. A population of about 900,000 is comprised within the limits of the proposed supply system. The investigation will include questions of protecting the purity of the supply and purifying the water. Forty thousand dollars has been appropriated by the State, and the expense of the investigation will eventually be paid by the municipalities included in the plan recommended by the board. The report must be submitted to the legislature not later than the first Wednesday in January, 1895, and must be accompanied with drafts of bills intended to provide for carrying out the recommendations made.

CONTEMPLATED WORK.

Marcellus, Mich., wants water-works.

Newnan, Ga., will have a system of water-works.

Rutland, Vt., will spend $50,000 for water-works extensions.

Owosso, Mich., will expend $20,000 on a system of water-works.

Work will soon commence on the Buffalo, Wyoming, water-works.

Shelbyville, Tenn., has declared in favor of a system of water-works.

A water-works system is proposed at Niles, Mich., to cost $32,000.

A new system of water-works is being introduced into Raymond, N. H.

Andover, N. Y., voted to expend from $15,000 to $20,000 in a system of water-works.

Sixty thousand dollars has been appropriated for the building of water-works at Ottawa, Ill.

An ordinance recently passed in Puyallup, Wash., proposes bonding the city for $60,000 for water-works.

The committees on finance and water-works at Falmouth, Mich., will purchase a new 8,000,000 gallon pump.

Waxahachie, Texas, has been negotiating for a system of water-works, but nothing definite has yet been done.

Greenville, Miss., is contemplating the construction of water-works, with or without sewerage, to be owned by the city.

St. Johnsville, N. Y., has voted to expend $25,000 on a new water-works system. The water will be obtained from artesian wells.

Frankfort, N. Y., will have water-works, the result of a special election being held for that purpose, deciding two to one in favor of them.

Napoleon, Ohio, will have a water-works plant and an electric light plant combined. Edmund S. Sykes, of Minneapolis, was awarded the contract.

The water commissioners of Dolgeville, N. Y., are contemplating a water-works system. They have appointed Frank K. Baxter, of Utica, chief engineer, and W. H. Collins, of Dolgeville, general superintendent of construction.

In the town of Southborough, Mass., a masonry dam is to be built for the Boston water-works. The length of the structure will be 2,000 feet and its greatest height, 75 feet. It will require about 240,000 cubic yards of earth and 13,400 yards of rock excavation.

Mayor Doyer, of Altoona, Pa., directed the water commissioners to readvertise for bids on the impounding reservoir at Kittaning Point. The contract was awarded the Continental Construction Company, of New York, last winter, but no work has as yet been done. Legal matters of some importance, between the common council and water commissioners, caused the delay.

CONTRACTS TO LET.

The board of public improvements, St. Louis, Mo., will receive bids until September 19th for two pumping engines.

Sealed proposals will be received at Brooklyn Village, Ohio, until Aug. 8, for the construction of water mains in sundry streets.

Sealed bids will be received by the village of Orrville, O., until noon August 7, 1893, for material and necessary labor for the construction of a system of water-works.

Bids will be received at the office of the board of administration until August 7th for four pumping engines of four and one-half million gallons capacity, Cincinnati, O.

Improvements and extensions will be made to the water-works systems at Hanover, N. H.; Rochester, N. Y.; Melrose, Mass.; Hamilton, Ohio, and Norwood, Mass.

Frank Dodge, clerk of the water committee of Portland, Oregon, asks for sealed bids until 3 o'clock, August 15, for a line of submerged pipes to be furnished and laid across the Willamette river. Bids must be addressed to Frank Dodge, and endorsed on the outside of the envelope, "Proposals for Submerged Pipes."

CONTRACTS AWARDED.

Col. M. B Birdseye has been awarded the contract for a seven miles extension of the Bradford, Pa., water system.

A contract has been awarded Kemish & Co., of Colchester, Ill., for a well-shaft for the city water-works at Bushnell, Ill.

Mr. Owen Patterson, of Baltimore, was awarded the contract for the construction of the water-works, at Middletown, Md.

The Berkeley Springs (W. Va.) Water-Works and Improvement Co. awarded the contract for the building of the water-works to James Lockhead, of Washington.

The contract for constructing water-works to supply the county almshouse and insane asylum at Blackwood, Pa., was awarded Charles M. Carre, of Camden, for $9,805.62.

E. T. Sykes was the successful builder for the construction of the water-works plant in LaGrange, Ind. He was awarded the contract at $17,315, to be completed by September 1st.

The Pottsville Water Co., Pottsville, Pa., has awarded the building of their new reservoir to Thomas F. Kerns, at a price of about $40,000. The dam will have a capacity of 100,000,000 gallons.

The Rockville Water and Aqueduct Company, of Rockville, Conn., awarded contracts for the new city water-works, amounting to $10,000. The Radford Pipe and Foundry Company was awarded the contract for iron pipe, and the Ludlow Valve Company was given the contract for hydrants and gates. The work will begin during August.

Cochranton, Pa., awarded the contract for a reservoir system of water-works, to Chandler Bros. & Co., of Beaver Falls, for everything but the reservoir, which was let to John B. Houser, of Meadville. The plant is to be completed by September 15th, at a cost of about $9,000.

The contract for the construction of the pumping station, chimney, gate and screen house, of the Brockton sewerage system, Brockton, Mass., was awarded Eldridge & Sylvester at $11,329. The other bidders were George Howard, $11,742; Prescott H. Jackson, $13,268; S. L. Washburne, $14,182; Daniel J. Cronin, $14,877.

W. W. Wahl, city clerk of Carroll, Iowa, writes that the city has let the contract for an extension of its water-works to Randall, Dickey & Jones of Carroll, for 77 cents per foot and twenty-nine dollars each for hydrants, and twenty-one dollars each for gate valves. About 3,200 feet of 6-inch mains will be laid during this season.

Parts of four bids were accepted by the water-works committee of the Canton, Ill., city council recently. The Addyston Pipe and Steel Co., of Cincinnati, furnishes the pipe at $20.80 a ton. They also furnish the connections at two and one-quarter cents a pound. The Bourbon Copper and Brass Works, of Cincinnati, was awarded the contract for hydrants and boxes. The Rensselaer Manufacturing Co., of Troy, N. Y., furnish the valves. The entire cost of material will be about $4,000.

BRIDGES.

The contract for the new iron bridge west of Westerville, O., has been let.

A brick bridge on Meridian street, Washington, Ind., was granted Warren A. Route.

A new bridge, to span the Fox, at De Pere, Wis., will be built at a cost of $30,000.

The city council of Atlantic City, Va., has voted $17,000 for a bridge on Second street.

A stock company has been formed for the purpose of bridging the Potomac river at Brunswick, Md.

The new iron bridge at Waterloo, Ill., will be a single span, 70 feet long, 20 feet wide, with 12-foot approaches.

The city government of Calais, Me., has voted to build a new free bridge across the St. Croix river to cost $40,000.

The new and only bridge across the Skagit river, at Mount Vernon, Ore., is completed at a cost of nearly $30,000.

The county court at its last quarterly term, La Grange, Tenn., appropriated $1,500 for the rebuilding of Wolf river bridge.

The stone work for the new iron bridge at Scott's Ford, Brownstown, Ind., has been commenced by McKain & Huber.

R. F. Hawkins was awarded the contract for building the highway Fisher bridge at Taunton, Mass., at a cost of $1,745.

Plans and specifications are being prepared for a bridge at Tacoma, Wash., from Eleventh street across the tide flats.

A large stone contract, consisting of two abutments, is contemplated by the county commissioners of Crawfordsville, Ind.

The commissioners of highways, Mattoon, Ill., contemplate the erection of a large steel bridge in Paradise township soon.

The Massilon Bridge Company has been awarded the contract for the Franklin street bridge, Greenville, Ind., at a cost of $70,000.

A new bridge will be built across the Kaw river at Turner, Kan. It is estimated that it will cost from $40,000 to $50,000 to build it.

Thos. White, of Grand Forks, got the contract for all of the bridges to be constructed in Grand Forks, N. D., for the ensuing year.

The six bridges at Anderson, Ind., were awarded the Indiana Bridge Company, of Muncie. The cost of the six structures will be $33,100.

Sealed bids for the construction of two truss bridges in Hanson township will be opened on the 9th day of August in the city of Aberdeen, Ohio.

The contract price is $6,300 for two new bridges across the Chippewa river, in the town of Cleveland, Wis. The work is to be completed by October 1, 1893.

A new iron bridge will be placed over the Pensankee river at Green Bay, Mich. Stone for the foundations and abutments have been placed and the iron will soon be ready.

The iron truss bridge over the Little Miami river at Milford, Ohio, is to have a span of 280 feet, a roadway twenty-four feet wide, with six-foot sidewalks on either side, and cost $50,000.

The contract for a new bridge to cross the Kentucky river from St. Clair street to Bridge street has been closed by the city and county authorities. The contract price, complete, is $62,500.

Four bridges over Cedar Fork creek will be constructed at Galesburg, Ill. They will consist of one span 22 to 24 feet between the abutments, with 36-foot roadway and 15 feet of footway on each side, with capacity of floor system to be, for roadway, 100 pounds, and for footway, 85 pounds per square foot.

The repairing of the Main street bridge which was badly damaged by the flood a few months ago, at Chillicothe, O., is progressing rapidly under the supervision of E. H. Wisohn, of Portsmouth, O.

An iron bridge and abutments will be erected over Onondaga creek, on South avenue, Syracuse, N. Y. The bridge will be 60 feet span, with 34 feet of roadway and 13 feet of sidewalk space on each side.

The contract for the Brooklyn-Brighton bridge calls for the completion of the substructure on or before September 15. The contract for the iron work will soon be let and the bridge will be pushed as rapidly as possible.

On the Solingen-Reimscheid Railway, in Germany, there is being built a bridge 1,640 feet long and 351 feet high at the highest point. The weight of the iron work will be 8,200,000 pounds, with 13,080 cubic yards of masonry in it.

Sealed bids will be received at the county clerk's office until Monday, August 7, for the following bridges, Leavenworth, Kan.: For bridge near Neely station, and for two bridges on road commencing at the De Soto road and running east 80 rods.

It is now proposed to construct a bridge over the Mersey, to connect Liverpool and Birkenhead. Designs have been drawn up by J. J. Webster, of London, and J. T. Wood, of Liverpool. The bridge will be an arched suspension in three spans.

The King Bridge Company, of Cleveland, Ohio, got the contract for building the Cold Spring bridge over Grand river, at Conneaut, Ohio. The bridge will be 140 feet long, and will cost $9,400, not including the abutments or approaches. It will be finished by September 1.

The contract for the substructure of a bridge across the Milwaukee river was awarded the Wisconsin Bridge and Iron Company for $27,897. Thomas R. Bently was awarded the contract for the substructure of a viaduct from Holton street to Van Buren street for $36,600.

The contract for the new steel wagon bridge over the Wabash, at Americus, Ind., was awarded the Lafayette Bridge Co., contract price, $28,600. It will be 400 feet long, divided into two spans of 200 feet each, with one pier in the river. The bridge is to be completed by December 1.

The contract for repairing two bridges, and building two new ones, at Decatur, Ill., was awarded F. G. McDonald. The commissioners had considered the idea of having the new bridges built of iron, for which there were a number of iron bridge builder's bids, but they concluded to have wooden bridges after they received the bids.

The board of commissioners of Marion county, Ind., will receive sealed proposals at the county auditor's office in Indianapolis, until the 28th day of August, for the substructure and superstructure of a bridge over White river at a point where Kentucky avenue, when extended, will intersect White river.

A first-class steel bridge will probably be built over the Ohio river at East Liverpool, Ohio. If the present plans are carried out, the piers may be built this season, the superstructure placed next year and the bridge ready for traffic in two years. This will be the only wagon bridge between Pittsburg and Wheeling.

It is estimated that the proposed new bridge over East river, at New York, will cost $8,000,000. Work will begin on it in September. All the dimensions of this bridge will exceed those of the Brooklyn bridge with but one or two exceptions. The structure will be called Bridge No. 1, because, when it is finished, work will begin on another, which will be called Bridge No. 2. Bridge No. 1 will not be completed for six or seven years.

James Young, bridge commissioner at Marysville, Ohio, will, on August 8 let the contract for building the following bridges: A forty-eight-foot bent, near Ira Moore's; a forty-eight-foot bent, near W. R. McKee's; a forty-eight-foot bent, near Wm. Atkins'; a forty-foot span, near H. A. Forcade's; a forty-foot span, near George Masters'; a forty-foot bent, near James Juhl's; a thirty-two-foot bent, near John Johnston's; a forty-foot bent, one-half mile north of Marysville; a forty-four-foot bent, one mile north of Marysville; a thirty-foot bent, near Wm. Groves'; a sixty-foot bent, near Henry Bowman's.

STREET LIGHTING.

An electric light plant will soon be put in at Woodstock, Vt.

Eastern capitalists will erect an electric light plant in Jacksonville, Fla.

The Electric Light, Heat and Power Co. of Lambertville, N. J., is in full operation.

Genesee, N. Y., will have electric lights, the tax-payers of that place having decided in favor of them.

Bids will be received until 12 o'clock, August 7th, for lighting any part or all of the streets in Toledo, O.

The tax payers of Batavia, N. Y., voted in favor of the purchasing of an electric lighting plant, for which $23,000 will be raised.

Gas lamps are being removed in Louisville, Ky., and the Electric Light Company is putting up a large number of electric lights in all parts of the city.

The contract for furnishing Niagara Falls, N. Y., with electric arc lights was given the Buffalo and Niagara Falls Electric Light and Power Co. at $90 per light a year.

H. E. Lindsley, city clerk of Centralia, Wash., writes that the city has contracted with the Northern Improvement Co. for twenty-five 2,000 candle power arc street lights at ten dollars each per month for one year. This reduces the price three dollars per month on each lamp, the former price having been thirteen dollars.

PUBLIC PARKS.

Urbana, Ill., will invest $8,000 in a park.

Fitchburg, Mass., makes a plea for securing lands for a public park, while they remain.

A park for the south-eastern portion of Grand Rapids, Mich., is being strongly agitated.

The board of park commissioners of Fort Smith, Ark., consisting of Messrs. C. M. Cooke, J. K. Barnes and J. B. Gass, has been organized and considerable new work and improvement is contemplated. They have control of three parks.

Duluth, Minn., has a beautiful park with a terrace drive, eight miles long, at an elevation of several hundred feet above the city. This drive is considered one of the most superb on the continent, and when complete will be twenty-five miles long.

The West Park Board has increased the improvement fund for Union Park, Chicago, Ill., from $7,000 to $10,000, to allow proper walks to be put down about the park. The commissioners of Humboldt Park have decided to open a boulevard through that park on the line of Division street.

The park commissioners of Audubon Park, New Orleans, La., promise to make that park one of the finest in America. The work of draining same has already been begun and the commissioners have written letters to New York, St. Louis, Chicago, Cincinnati and Philadelphia, asking those in charge of the parks of the great northern and western cities to send to New Orleans the general plans that were followed in making Central Park, Lincoln Park and other similar public places.

STREET RAILWAYS.

Alexandria, Va., wants a belt line street railroad.

An electric street car system is proposed at Junction City, Kansas.

The electric street car system in Brazil, Ind., is now in full operation.

Surveys have been made for an electric railway between Middletown, Md., and Frederick.

Marion, Ind., is to have an electric railway from Marion to Camden by way of Montpelier.

The work of putting down the rails for the new electric cars was recently begun at Groveland, Mass.

A new electric railway has been put in operation at Coney Island, which is operated with insulated trolley wires in a conduit.

A new down town loop will be constructed in Cincinnati in Fourth, Walnut and Fifth streets by the Mt. Auburn Cable Railway.

A franchise has been granted the American Railway Improvement Company for an electric railway from Quincy, Mass., through Braintree, to connect with a line in Holbrook.

The Milwaukee and Wauwatona Railway, Milwaukee, which now employs steam as a motive power, will soon be changed to an electric road.

The Norfolk Suburban Street Railway Company's electric road, from Dedham, Mass., to Mattapan, will be in running order by October 15.

The Norwalk Horse Railway Company, Norwalk, Conn., is contemplating the introduction of electricity in place of horses in the near future.

The city council of Bradford, Pa., has granted a franchise to the Kendall Street Railway Company to construct and operate an electric railway.

The Montreal Street Railway Co., an organization that controls the street railways in Montreal, Winnipeg, Ottawa, Toronto and London, proposes an electric railway from Montreal to Quebec.

In St. Louis a street car company is operating air brakes on its own cars. In the distance of one block, it is stated, a car can be stopped ten times.

The Nashua and Haverhill Electric Railway Co. proposes an electric line between Haverhill, Mass., and Nashua, N. H. The distance is twenty-two miles.

The city clerk of Cuyahoga Falls, Ohio, writes that the council has under consideration the construction of another street railway between Silver Lake and Akron.

Within a short time St. Louis will, it is claimed, have the most complete electric car system in the world. But two of the old horse lines remain to be converted into electric systems, and this change will soon be made.

The objections raised by the ecclesiastical authorities that the proposed electric elevated railway in Berlin would pass the Luther church have been overruled by the Emperor, to whom the matter was referred. It will probably take two years to build the road.

Duluth, Minn., has fifty miles of electric street railway track, and an inclined street railway running cars to the summit of the hill back of the city. The line is operated by cable and stationary engines at the upper end of the city. Duluth, West Duluth, Lakeside, Woodlawn and Highland Parks are connected by electric cars.

MUNICIPAL BONDS.

The mayor of Faribault, Minn., asks for bids until August 5 for the purchase of $31,000 5 per cent. bonds.

The city clerk of Defiance, Ohio, invites bids until August 8, 1893, for the purchase of improvement bonds of that city.

Bids are invited until August 11 for the purchase of $8,000 of 6 per cent. street improvement bonds by W. W. Montgomery, Fort Clinton, Ohio.

SEALED PROPOSALS.

CONSTRUCTION OF SEWER.

Sealed proposals will be received by the City Clerk at his office until 12 o'clock noon on August 11, 1893, for the construction of a sewer on Beallie avenue, from Liberty street to University street, according to plans, profile and specifications furnished by the City Civil Engineer. This sewer will be 3,971 feet in length and about 3,900 feet of laterals, and is to be constructed of 12-inch fire clay sewer pipe of the best material. The pipe used in this improvement must be subject to the approval of the City Civil Engineer. Bids will be received for either labor or material, or for both; if for both, each must be separately stated, with the prices. Bids must be on forms furnished by the City Civil Engineer, and each bid must be accompanied by a certified check of 10 per cent. of the amount of the bid, payable to the City Clerk, as a guarantee that the contract will be entered into. The Council reserves the right to reject any or all bids. By order of City Council. C. C. ADAMS, City Clerk.

Wooster, O., July 12, 1893.

STREET PAVING.

Sealed proposals will be received at the office of the Board of Administration, Cincinnati, O., until 12 o'clock noon of Friday, August 11, A. D. 1893, for the improvement of Hollister street, from east curb line of Vine street to west house line of Auburn avenue, by grading, setting curbs, paving the roadway with brick, and constructing the necessary culverts, drains and retaining walls, in accordance with the plans and profiles on file in the office of the Chief Engineer of the Board of Administration and according to specifications on file in the office of the Board of Administration. The same to be paid for as provided in the resolution and ordinance for said improvement. The board reserves the right of rejecting any or all bids. Bidders must indorse their names and address upon the outside of the envelopes containing their bids. Each bid to be accompanied by two disinterested sureties. Bidders to use the printed forms, as no other will be received. By direction of the board.

AUG. HERRMANN, President.

A. P. BUTTERFIELD, Clerk.

STREET PAVING.

Sealed proposals will be received by the undersigned up to 12 o'clock at noon of Monday, August 14, 1893, for improving Sixteenth street, from the paving in Washington street to the paving in Adams street, by paving the central twenty-four feet thereof with either Medina stone, cedar blocks, vitrified brick, asphalt blocks, Trinidad asphalt, Hallwood blocks or other vitrified blocks, together with the necessary grading, curbing, gutters, crosswalks, drainage, etc.

The contractor, or contractors, who shall do the work herein provided for shall be paid in cash within ninety days after the completion of the work and acceptance thereof by the city.

All bids must be written with ink, and the price of each item shall be written out in full as well as in figures. Each bid must contain the full name of every person interested in the same. All parties filing bids for the matters specified in this notice must deposit with the City Clerk, on each bid, the sum of five hundred dollars. All deposits to be in cash or certified check on a bank doing a regular banking business in the City of Toledo, and accompanied by an agreement signed by the bidder and two disinterested persons, guaranteeing that, if the bid is accepted, a contract will be entered into—otherwise the amount deposited to be forfeited to the city; and in case a contract is entered into, said deposit to remain until the first estimate of work done (or double the amount of deposit) is reported to the Common Council.

Bidders will be required to endorse their names on the outside of the envelope containing their proposal, and what the bid is for, the same to be filed with the City Clerk. Bids not filed in accordance with the above requirements will be rejected. Blank bids and envelopes can be obtained of the undersigned or of the City Civil Engineer. Bidders must specify the time within which they will commence and complete the work after the acceptance of their bid. Plans and specifications can be seen at the office of the City Civil Engineer. The Council reserves the right to reject any or all bids. By order of the Council. SYLVESTER LAMB.

Toledo, O., July 10, 1893. City Clerk.

SEALED PROPOSALS.

SEWER PIPE.

Notice is hereby given that sealed offers will be received to furnish sewer pipe of sizes and quantity as follows, viz: 6,550 feet of 24-inch sewer pipe; 2,600 feet of 20-inch sewer pipe; 2,100 feet of 18-inch sewer pipe; 3,500 feet of 15-inch sewer pipe. All pipe furnished to be first-class in every particular and sample to accompany offer. Bids to be on file with the City Clerk on or before August 9, 1893, at 7 o'clock P. M. The right to reject any and all bids is reserved, and all material to be subject to inspection by Engineer before acceptance.

By order of the Board of Public Works.

W. J. MILLER, City Clerk.

Dated Ann Arbor, Mich., July 20, 1893.

NOTICE OF THE SALE OF BONDS.

OFFICE OF THE CLERK OF THE CITY OF DEFIANCE, O.
July 6, 1893.

On Tuesday, the 8th day of August, 1893, at the hour of 2 o'clock P. M. at this office, the following described bonds of the city of Defiance, Ohio, will be sold to the highest bidder, at not less than par value thereof, and accrued interest to the time of transfer:

1. Thirty-three bonds, designated as "East Hopkins street, between Ottawa avenue and Auglaize street, improvement bonds," and numbered consecutively from No. 1 to No. 33, inclusive, each of the sum of $500, bearing date July 1, 1893; the first one of said bonds, in the order of their numbers, to become due on the 1st day of July, 1895, and two of said bonds, in the order of their numbers, to become due on the 1st day of January, and on the 1st day of July, in each year thereafter, until all of said bonds have matured; and all of said bonds bearing interest, at the rate of six per cent. per annum, payable semi-annually, and having coupons for the several installments of interest thereto attached. Said bonds are issued to provide means for the payment of the costs and expenses of the improvement of the above mentioned portion of East Hopkins street, under the authority of an ordinance of said city passed June 20, 1893, entitled "An ordinance to improve part of East Hopkins street, in the city of Defiance, Ohio, and providing means for the payment of the costs and expenses of said improvement."

2. Thirty-four bonds, designated as "Hopkins, Jefferson and Fifth streets, between Francis street and the Canal, Improvement bonds," and numbered consecutively from No. 1 to No. 34, inclusive, each for the sum of $500, bearing date July 1st, 1893, and two of said bonds, in the order of their numbers, to become due on the 1st day of January, and on the 1st day of July, in the year 1896, and in each year thereafter, until all of said bonds have matured; and all of said bonds bearing interest at the rate of six per cent. per annum, payable semi annually, and having coupons for the several installments of interest thereto attached. Said bonds are issued to provide means for the payment of the costs and expenses of the improvement of the above mentioned portions of said Hopkins, Jefferson and Fifth streets, so as to form one continuous improvement, under the authority of an ordinance of said city, passed June 20, 1893, entitled "An ordinance to improve part of Hopkins street, Jefferson street and Fifth street, in the city of Defiance, Ohio and providing means for the payment of the costs and expenses of said improvement."

All of the bonds hereinbefore described are issued in strict conformity to the Constitution and statutes of the state of Ohio and the said several ordinances authorizing their issue and the general ordinance of said city regulating the issue and sale of bonds.

Sealed proposals for said bonds will be received at this office until the time so as above fixed for the sale thereof, and all bidders are required to state the kind and number of bonds bid for and the gross amount they will pay for the same and accrued interest to the time of transfer.

The City Council, however, reserves the right to reject any and all bids for said bonds and to order a new sale thereof.

Proposals must be sealed and indorsed "Bids for Bonds," and addressed to Clerk.

By order of the City Council.

J. J. MALLEY, City Clerk

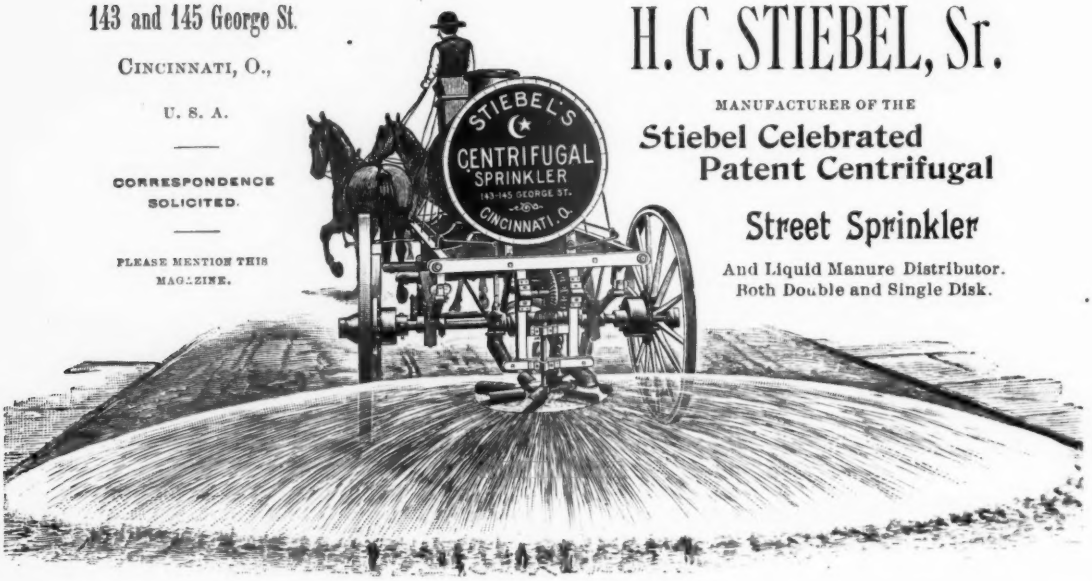
143 and 145 George St.

CINCINNATI, O.,

U. S. A.

CORRESPONDENCE SOLICITED.

PLEASE MENTION THIS MAGAZINE.



H. G. STIEBEL, Sr.

MANUFACTURER OF THE

Stiebel Celebrated Patent Centrifugal Street Sprinkler

And Liquid Manure Distributor. Both Double and Single Disk.

• STIEBEL'S •

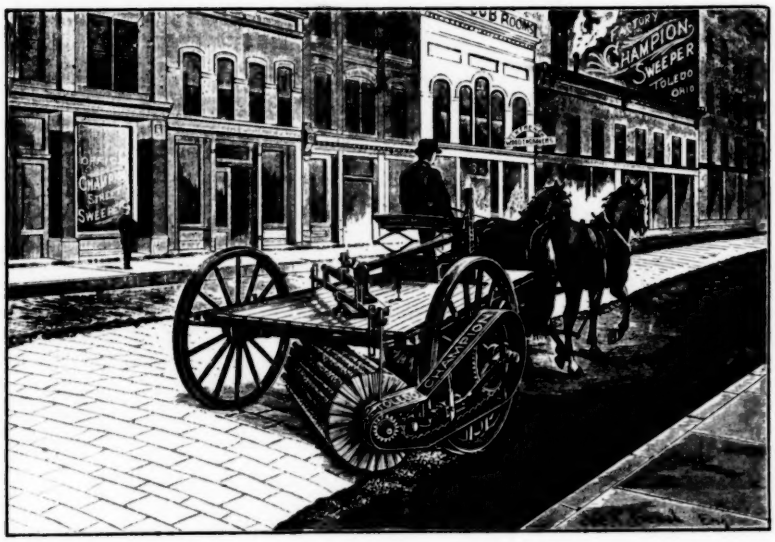
CENTRIFUGAL PATENT SPRINKLER

BOTH DOUBLE AND SINGLE DISCS.

ECONOMY! SIMPLICITY! UTILITY!

In calling the attention of the public to Stiebel's Patent Centrifugal Sprinkler, we wish to emphasize the advantages which it presents as appreciable by skilled as well as unskilled men. As may be seen from the cut, the well known centrifugal power is utilized for distributing the water over the streets uniformly, economically and with the least possible labor. The gearing is of the simplest and most effective construction, strongly built and easily repaired by any blacksmith. By former methods the water carts had to pass up and down the streets three or four times, while in the device presented the attachments may be made to throw the water from 35 to 55 feet—*i. e.*, from curb to curb. In this way the number of carts, horses and wagons needed is reduced 50 per cent. or more, as exemplified in various cities where the Centrifugal Patent Sprinklers have been adopted, and where in one place the number of wagons has been reduced from 41 to 19. The importance of such reduction of constant labor will be recognized by all interested in reducing the expenditures of corporations in this line, and, as a natural consequence, can not but appeal to the minds of all who are working to reduce the taxes under which the people groan. Not only is labor saved, but by the new method there is no more filling up of the holes with water in the streets, and by the equal and uniform distribution more than one-third of the water is saved. In streets narrower than 30 feet one side can be made to do the work, either side or both being capable of complete control. The attachment is adjustable to the wagons now generally in use, so it is apparent that by a slight present outlay many thousands can be saved the public in future. Many testimonials in our possession from those who have had practical acquaintance with this device, and we ask, as we feel entitled to do, that it engage your earnest consideration, for we believe it to be one of the most economical, simple and useful of the machines which this age of inventions has produced.

H. G. STIEBEL, Sr.



To the Hon. the Board of Public Works of the City of Saginaw:

GENTLEMEN—The question of purchasing street sweeping machinery for the eastern highway department, which was brought to your attention some time ago and referred to us to examine and report to you, has been under consideration by us for some time, and we now submit the following for your consideration:

We have examined the cuts and recommendations of six different machines and the testimonials of each from the city officers and municipal authorities of the cities where they are in use, and such other information as could be procured by correspondents, and we are of the opinion that the "Champion" is the best machine, everything considered, for our use.

The merits of the machine briefly are these: It will sweep from two to four inches of mud and street accumulations into windrows with one team of horses at one sweeping. It will sweep equally well on all kinds of pavements in all conditions. The use of steel wire in place of rattan or bass in the broom enables it to sweep equally clean in mud or dust and at a saving of nine tenths of the cost of keeping the brooms in repair.

Yours respectfully,

R. W. ROBERTS, City Engineer.

ALLISON J. MCINTYRE, Sup. of Streets.

At the meeting of the Board of Public Works, held March 18, 1893, the City Engineer was instructed to order "Champion" sweeping machine according to the recommendations hereto annexed.

Very respectfully, ALFRED DAVIS,
Clerk of the Board.

WHAT THE

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They will move from 2 to 4 inches of wet mud and street accumulations into windrows, with one team of horses to each machine.

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They will leave the streets cleaner than the most careful work done by hand, shovels and brooms, at one-tenth the cost of the latter.

They will sweep equally well on asphalt, cedar block, Medina stone, cobble-stone, macadam and brick paving.

One steel Broom will outwear from 10 to 20 of the rattan brooms now in use in other machines.

One Steel Broom, in constant use, will wear from 10 to 14 weeks.

Twenty dollars' worth of steel fibre will wear as long as two hundred dollars worth of the rattan used in other machines.

They will save their cost, broom and all, in half the first year's use.

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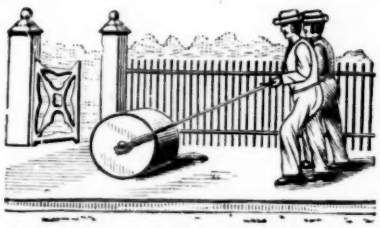

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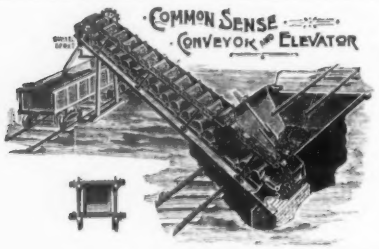

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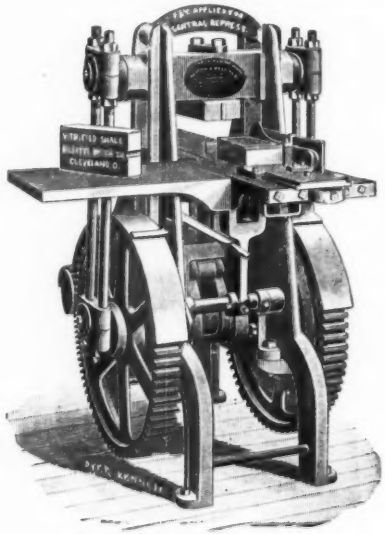

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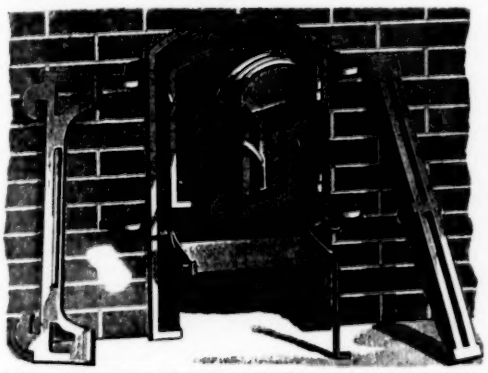

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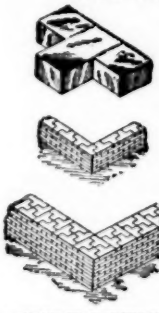

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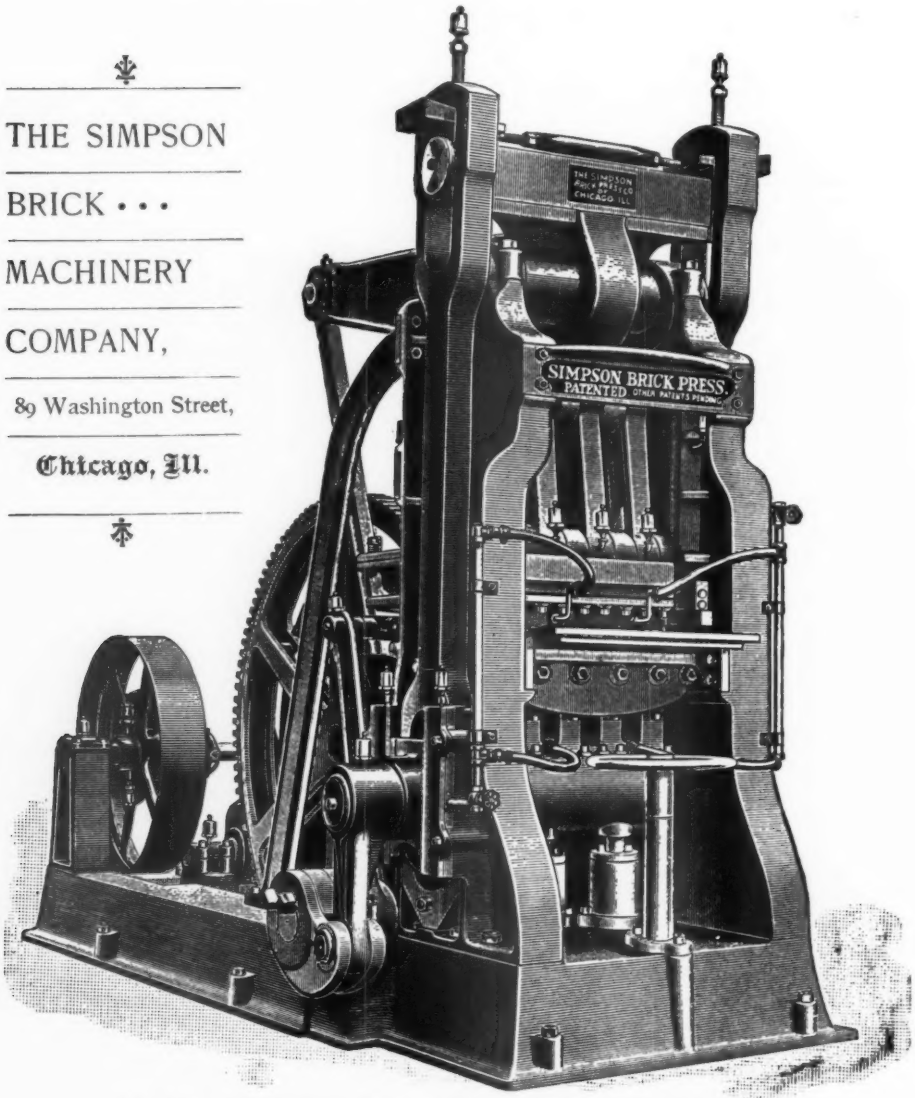

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